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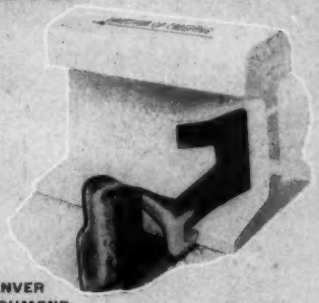

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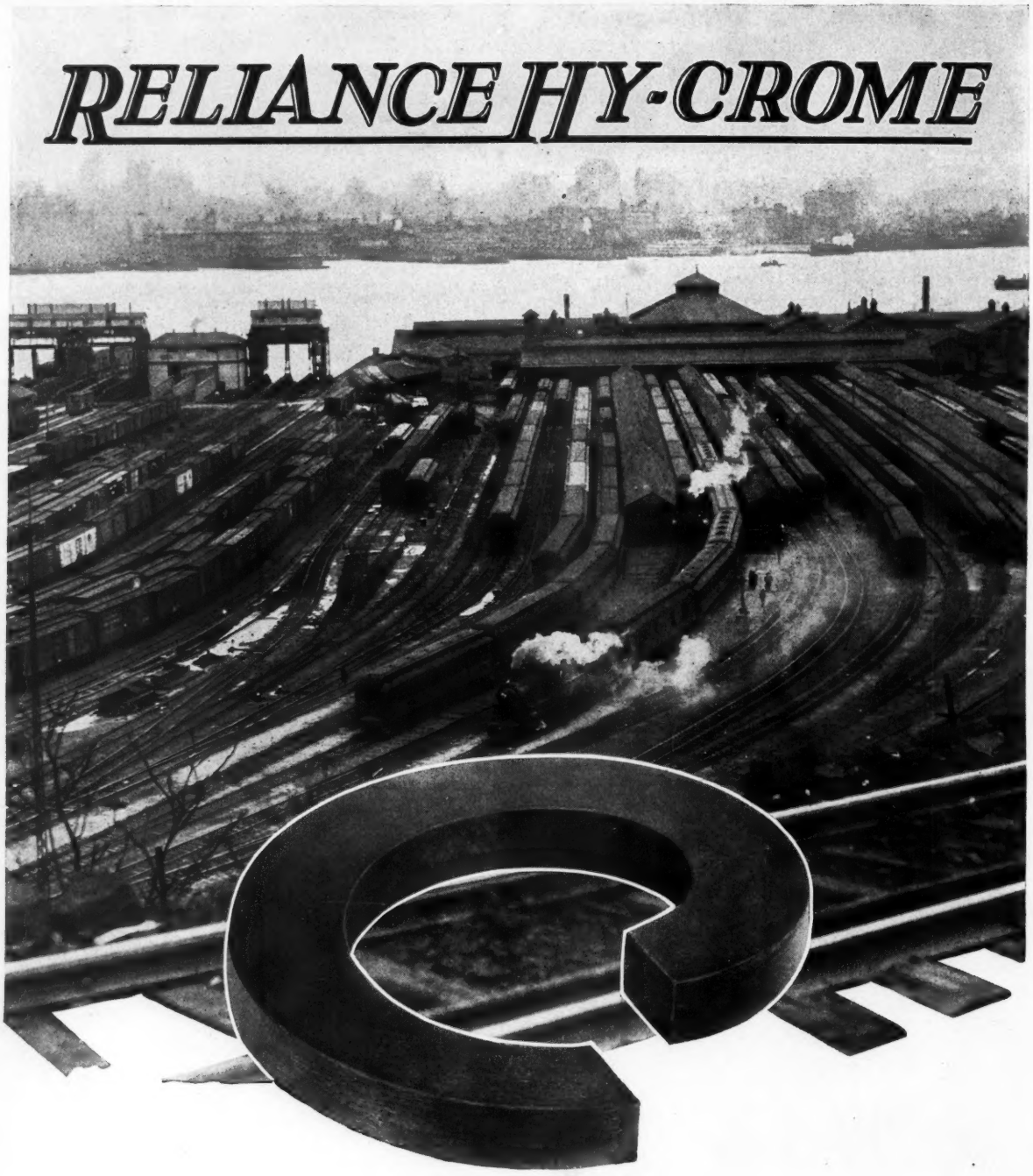

During the heavy Christmas traffic RELIANCE HY-CROME NUT LOCKS helped to make traveling safe for millions of travelers on many lines, and their vigilance will not be relaxed for an instant throughout the New Year nor for many years to come. *"SAFETY FIRST."*

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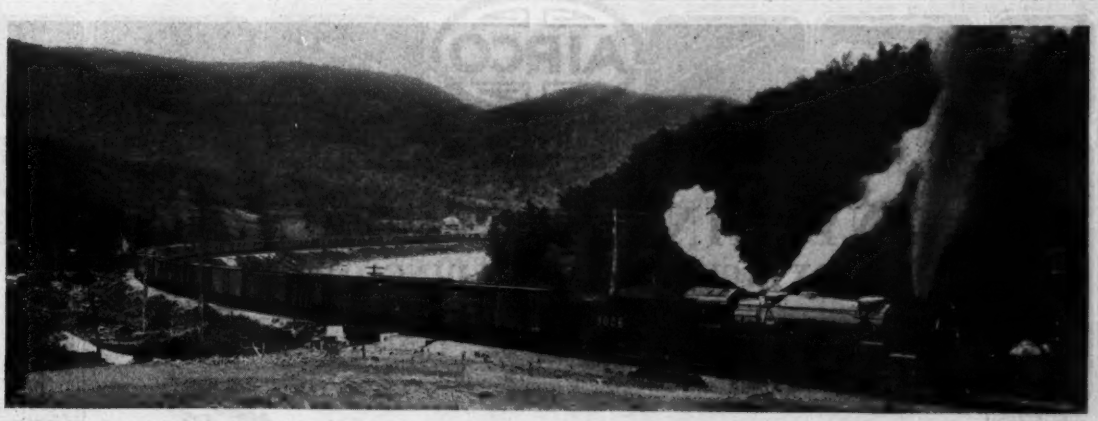

On the Boston & Maine in the Berkshire Mountains.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 19 January, 1922 Number 1

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How materials should be distributed for rail laying?
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Answers to these and other practical questions will be found elsewhere in this issue.

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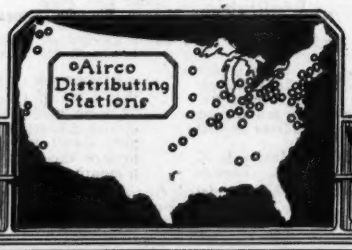

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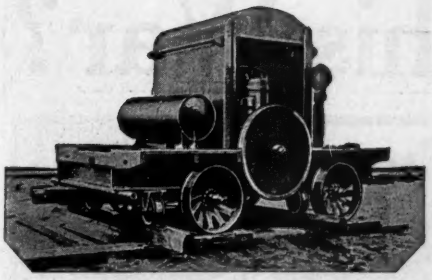

The portable 4-Tool Tie Tamper Compressor supplies the air power

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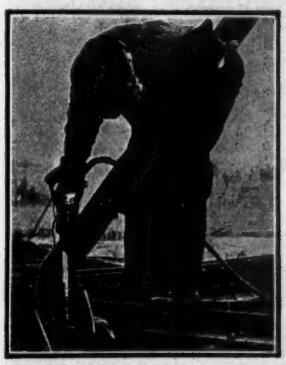

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Detroit & Toledo Shore Line	1921	2 orders
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Missouri Pacific	1921	2 orders
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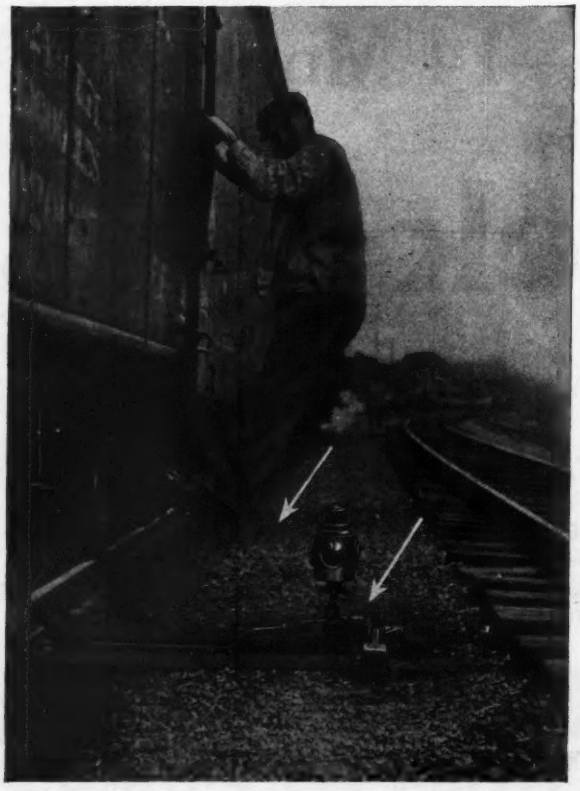

SAFETY

Bethlehem Model 1222 Switch Stand

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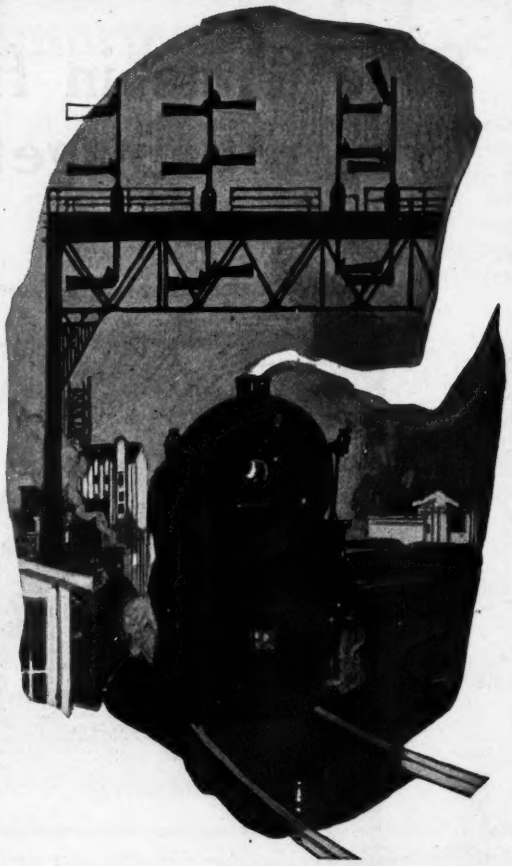

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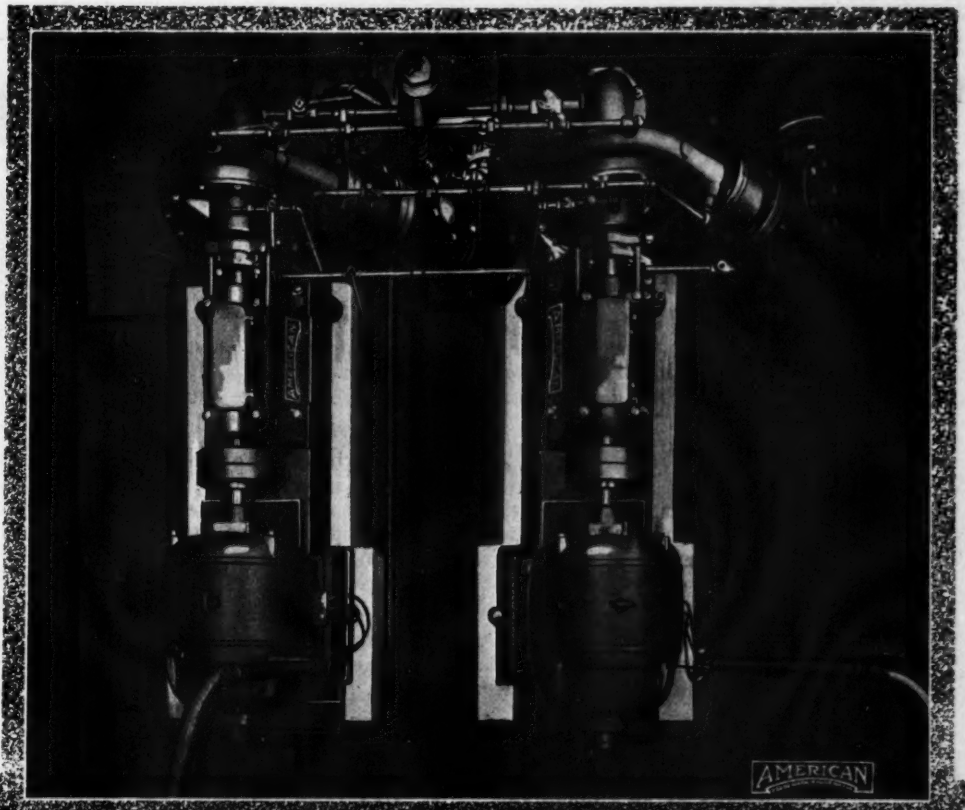

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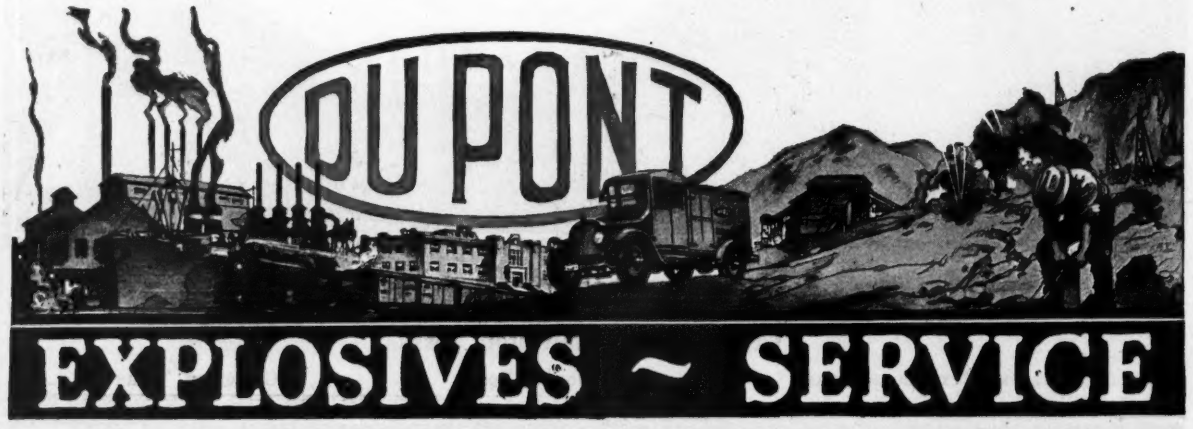


Railway Engineering and Maintenance

Volume 19 January, 1923 No. 1

RAILWAY ENGINEERING AND MAINTENANCE

EFFECTIVE with this issue the name of the *Railway Maintenance Engineer* is changed to *Railway Engineering and Maintenance*. At the same time the number of editorial pages is increased to permit the inclusion of more information relative to the design, construction and maintenance of bridge, building and water service facilities.

Since the establishment of the Maintenance of Way Section in the Railway Age in 1911 and its development into the Railway Maintenance Engineer in 1916, there has developed a closer contact between engineering and maintenance until today they are merged on many roads. This increasingly intimate relationship has been apparent in the Roadmasters' Association, the Bridge and Building Association and the American Railway Engineering Association. It has also been reflected in the editorial contents of the *Railway Maintenance Engineer* and its circle of readers until today this paper is read by nearly every officer, of technical or practical training, in charge of the construction and maintenance of the roadway and structures. The new name has been adopted in order to indicate more accurately the nature of the editorial contents and the character of the readers of this publication.

The additional attention which will be given to bridge, building, and water service problems, is a recognition of the increasing importance of these phases of construction and maintenance. By the addition of extra pages these developments will be treated more adequately without detracting in any way from the space now devoted to the problems of track construction and maintenance, or eliminating any other feature now appearing in the paper.

It is our thought that by broadening the scope of the paper, *Railway Engineering and Maintenance* may be able to serve those engaged in the design, construction and maintenance of the roadway and structures even more fully than in the past, and it is our hope that the paper may merit the continued support of engineering and maintenance officers alike in its efforts to promote the interests of this important branch of railway service.

Looking For the Leaks

As plans are now being prepared for next season's program of improvement work it is well to make a careful survey of the deficiencies which were apparent during the last year in order that the means for their removal may be given adequate consideration in common with other projects. A railway property is in a state of continuous development. As traffic and earnings increase added facilities are required and higher standards of maintenance are justified. A defect once considered of little consequence becomes a serious matter. The most certain means of improving a property is to strive continually for the elimination of the most outstanding deficiencies from the standpoint of the division, sub-division or section and in its relation to the system as a whole. Considered locally, the shortcomings lead to a variety of troubles. Trains may be delayed in switching at certain way stations because of inadequate or poorly arranged trackage. A building may require frequent repair because of inadquate foundations. These are typical of many conditions which constitute a serious drain on almost every railway. Many of these conditions can be remedied at relatively small cost, once attention has been called to them. The first and frequently the most difficult step is to detect these conditions, particularly if they have been of long standing and have come to be regarded as unavoidable. This is the season when a special effort should be made to bring all such conditions to light.

If You Want the Index Ask for It

Readers are reminded that the index of the *Railway Maintenance Engineer* for the last 12 monthly issues ending with that for December, 1922, is available for distribution, and will be sent without charge to those who request it. Subscribers who bind their copies, or who for other reasons desire to have the index are asked to address their requests for the 1922 index to the editor.

The Outlook For the New Year

The year which has just closed has been one of marked contrasts in the railway industry. Wide fluctuations in traffic and in earnings; marked unrest and sporadic strikes among maintenance of way employees; a deflation in wages in the summer followed by an upward tendency toward the end of the year; the curtailment of much work in the spring, followed by the opening of many new projects toward the end of the year and the promise of more in 1923, all indicate that the process of stabilization and of recovery after the World War is not yet completed. However, there is no question but that we have made good progress in our return to normal conditions. The year was characterized by the largest car shortage and by the longest sustained period of heavy traffic in history. As a car shortage is usually the manifestation of the inadequacy of terminals and other facilities, the congestion of the last few weeks has shown the necessity

for additional facilities in many places. The indications are that traffic will continue to move in large volume during the early months of the new year. This gives promise of earnings which will warrant the construction of the facilities required to give adequate capacity and to promote economies of operation. Much work was undertaken in 1922. Much more work is in prospect for 1923, a large part of which has already been authorized. An analysis of the budgets of 27 railways with an aggregate mileage of 95,000 shows over $350,000,000 definitely scheduled for specific improvements and additions.

THE LABOR OUTLOOK

WITH the indications for wide-spread activity among the railways this year one immediately turns to the labor situation to ascertain the limitations which it will impose. The year which has just closed began with a demand for a deflation in wages of which the Labor Board took cognizance in its reductions for maintenance of way employees effective July 1. As the summer advanced and industrial activities increased conditions were reversed; the demand for men soon exceeded the supply and wages began to rise on the railways and elsewhere. As far as common labor is concerned the increases granted by the Labor Board and by individual railways in recent weeks have retarded but not stopped the general movement of men to other industries, with the result that even though the forces of the railways are now on a winter basis, many roads are short of labor in the industrial districts.

If the present indications are an index of what may be expected, 1923 will see an acute shortage with increased wages, large turnover and other attendant evils. Industry in general is expanding and requiring more men, absorbing practically all of those who have been released by the closing down of seasonal occupations. When the railways come into the market next spring it is doubtful that they will secure more than a fraction of their requirements. With such an outlook the problem now is to so organize the season's operatins as to enable the maximum amount of work to be accomplished with the limited forces available. This means supplementing manual labor with mechanical equipment.

In normal times labor saving equipment is accepted only as it demonstrates its ability to reduce costs. Now it should be sufficient if it will enable more work to be done with a given number of men, even though the cost may be the same. From sheer necessity the roads must turn to labor saving equipment. Many devices have already been perfected to the point where their practicability can be demonstrated. Such devices should receive greatly increased application in the current year.

THE COST OF WASTE

Suppose someone asked you to haul 200 10-lb. packages of freight one mile in a wheelbarrow on a hot day. Suppose you hired a man to do the work for you, and he was so careless as to lose or damage some of the freight which would cost you as much as you received for handling it. Wouldn't you feel that your employee should abandon his careless habits? This company expends as much energy in moving a ton of freight one mile as you would with your wheelbarrow, yet numbers of its employees are equally wasteful with materials and supplies daily. The company must haul one ton of miscellaneous freight one mile to obtain the money necessary to replace two torpedoes or one railroad spike. It must haul 3 tons of freight one mile to replace a nut lock, 5 tons of freight one mile to replace a track bolt, 55 tons of freight one mile to replace a cross tie or 4 carloads of freight one mile to replace a pair of 90-lb. angle bars. If the expense of operation is deducted, approximately 20 times the number of tons given above must be handled one mile to make a profit sufficient to pay for those articles. The same principle applies to time wasted, for which the company pays and for which it is entitled to full service for the railway must handle a ton of freight one mile to pay the wages of a maintenance of way foreman for one minute.

From an article in the N. C. & St. L. Bulletin by J. B. Hill, assistant to the president.

THE ROADMASTER OF THE FUTURE

IN HIS TALK before the Maintenance of Way Club of Chicago on the qualifications of a roadmaster (published on a following page in this issue) E. P. Bracken set a high standard for this position. In addition to an ability to maintain good track, he emphasized the advantage of education beyond that heretofore considered as essential by many maintenance of way officers. However, having himself served as a roadmaster for many years and more recently for several years as operating vice-president of the Chicago, Burlington & Quincy and being thus familiar with all phases of a roadmaster's duties, he is well qualified to discuss this subject and his conclusions deserve careful consideration.

Railway operation is entering a new phase in all of its branches. The necessity for greater preparation applies as directly to the division superintendent or to the general manager as to the roadmaster. The ability to get trains over the road or to maintain good track is as necessary as ever. To these duties has now been added the requirement that these operations shall be performed economically. A knowledge of costs, an ability to analyze methods and to determine accurately the relations of cause and effect are requisites of growing importance. The ability to organize forces and to get work done must be co-ordinated with that power of analysis which will enable this work to be performed economically as well.

In laying stress on a technical education, one commonly thinks of a college training. Yet this is not necessarily implied. Some of the leading engineers in railway service and elsewhere have never attended such an institution. They have, however, acquired the equivalent education by individual study. In the same way those in maintenance of way service have a similar opportunity to meet the increased qualications for roadmasters and supervisors of bridges if they are willing to make the effort. Likewise, while a technical education is an important asset, it alone is not sufficient. With it must be combined a knowledge of the practical phases of maintenance of way work which can only be acquired by means of an apprenticeship of the work itself.

There is another phase of this problem which is frequently overlooked. A large and highly specialized organization, such as a railway must continually have men coming up through its ranks who furnish timber for officers. It is not enough to operate for today; the officers of tomorrow must be in training. For this reason it is not enough that the roadmasters must be able to keep up their present duties. They should also contribute their quota of superintendents and higher officers.

WHEN PROOF AGAINST FROST IS PROOF AGAINST FIRE

BY this time the winter in much of the country has advanced to the point where the subject of frost protection should be receiving special attention by every officer engaged in water service. Undoubtedly it is receiving that attention in many places, or has been taken care of so thoroughly earlier in the season as to eliminate the need of concern about it now—if, indeed, that is possible. But, unfortunately, the same cannot be said of all territories. While in no place are officers so oblivious to the possible consequences of winter as not to have taken some measures to afford frost protection, it develops too often that no real interest is manifested until a freeze-up has occurred, when steps are then taken to make repairs.

But this is not frost protection, nor is it even frost correction unless the weakness which has been disclosed is so remedied as to remove the possibility of its recurrence. Instead, the frost has done its work and the damage which it is the functions of frost protection to prevent has actually occurred. Often, to be sure, this damage may be inconsiderable—a matter of a frozen faucet or the valves in the pump chamber, which may be easily and quickly repaired. Not at all infrequently, however, it may be a pipe line located somewhere underground, or a burst valve, or water main through which the water in storage drains away, or it may be the riser in an elevated tank, or the drain lines beneath a treating plant that constitutes the seat of the trouble.

Incidents of this kind very often testify not only to mismanagement on the part of the officer in charge that may be expected to exhibit itself elsewhere in his work, but constitute the source of more expense annually than is often realized. For instance, a freeze-up may often warrant the charge that the frost protection which was provided, having failed, simply represents so much money wasted. Again, where the frost has reached underground pipes there is often the unusually large cost of excavating and replacing frozen material under conditions which in themselves are anything but favorable to economical work. When valves are cracked and pipe lines or even pumps are bursted, there is also the heavy expense of making renewals, an expense which frequently runs into hundreds of dollars in a single winter. And always there is to be considered that while repairs are in progress, the installation is often out of service, adding to road expenses; that on the large jobs, a gang may be required which may be needed elsewhere, and that even on the small jobs a repairman may be required to spend a day or more in making the repairs owing to the distance of the seat of the trouble from headquarters.

But, aside from these direct effects, there is a further expense often associated with frost troubles in water service, which represent losses not infrequently making the direct ones seem insignificant. These are the losses that arise from fire, resulting from efforts made to thaw out frozen lines. It is a fact too well established to be questioned that a very considerable number of losses that water service property suffers from fire arise from this source, a pipe line freezing up within or adjacent to the walls of the building and an innocent fire getting beyond control and seriously damaging or entirely consuming the structure, being the usual explanation of the cause and the not infrequent effect of the fire.

Appreciating these losses, the lesson for officers having this work in charge is plain. It is to provide frost protection before trouble is encountered and of a character that will prevent its occurrence. This may require a closer study of the subject than some officers perhaps have been inclined to give to it, especially when the fault does not arise so much out of a lack of effort to afford the protection as from a deficient knowledge of the most effective manner of securing it. The problem of frost protection therefore requires not merely the blind repetition of what was done in previous years, but an analytical study of banking materials and methods, a knowledge of the depth of frost lines and of conditions under which an installation is operated, etc. But whatever the studies which must be made to secure effective protection against frost, the fact remains that every officer, if he has not already done so, should take immediate steps to provide it, in the knowledge that it is cheaper to keep out frost than to drive it out, and with the encouragement that to make an installation proof against frost is also to make it proof against fire.

NEW BOOKS

Manual of Recommended Practice of the American Wood Preservers' Association.—133 pages, illustrated 4½ in.x7 in. Bound in leather. Published by the association, S. D. Cooper, secretary, A. T. & S. F., Topeka, Kan.

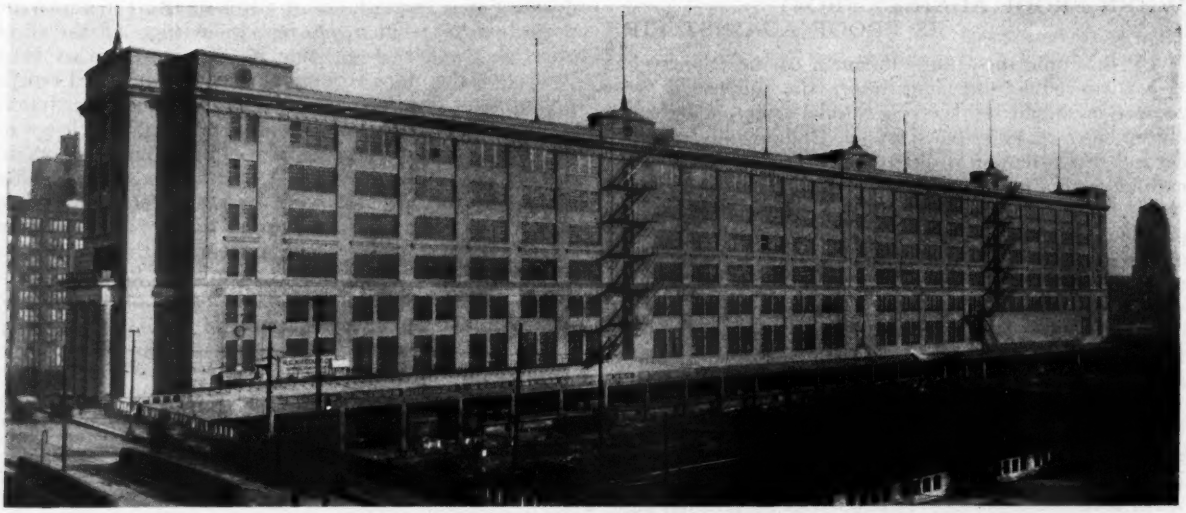
For several years there has been a demand for the publication in one volume of the standards which the American Wood Preservers' Association has adopted in its conventions from year to year. This demand has been met by the publication of this volume, which is not intended as a complete text book or treatise on wood preservation, but as a reference guide for engineers, architects and others who have occasion to use wood which is subject to the attacks of marine borers, fungii, or insects. The volume contains the standards adopted by the American Wood Preservers' Association for creosote and for methods of testing it for various constituents; for creosote coal tar solution; for zinc chloride; specifications for interior wood block floors and for wood block paving; definitions of processes and a large amount of tabular and other information valuable to the user of timber. The book is prepared in loose leaf form so that additions can be made readily.

Surveying and Boundaries.—By Frank Emerson Clark, member of the Minnesota Bar. 632 pages, 117 illustrations, 6 in. by 9¼ in. Bound in cloth. Published by Bobbs-Merrill Company, Indianapolis, Ind.

Few problems confronting the railway engineer are more knotty than those involving property lines and titles to property. In the course of their work it frequently becomes necessary to retrace boundaries and to establish title where few, if any, records are available.

This book has grown out of the extended experience of the author as a public and private surveyor and later as a practicing lawyer who was often called upon to investigate land titles. The book sets forth the laws pertaining to surveying and discusses the problems confronting the surveyor and the lawyer in the location and settlement of boundaries. It furnishes a ready reference to the Acts of Congress providing for the survey of the public land and instructions and suggestions of federal officers relative to the restoration of lost or obliterated corners, etc. The problems of riparian rights and the division of cove flats are typical of a wide variety of special problems which are also treated in this volume.

The book is divided into twenty-seven chapters; the first eight of which apply particularly to those states having the rectangular system of surveying, seventeen chapters are applicable to all states, and the two concluding chapters refer to the problems arising in the original thirteen states and the Dominion of Canada, respectively. Among the chapter headings are those on Meander Corners and Meander Lines; the Restoration of Lost or Obliterated Corners; the Meaning of Words in Descriptions; Adverse Possession; and Highways.



The Mail Building From the West Side. The space in the Foreground Will Be Occupied by Union Station Tracks.

New Railway Mail Building at Chicago An Unusual Structure

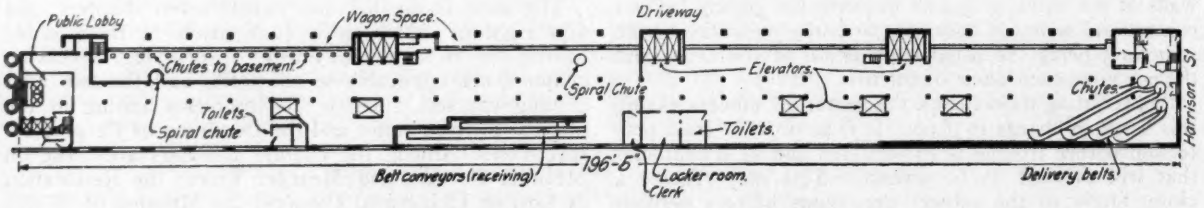
$4,000,000 Postal Terminal Recently Completed Is Important Feature of New Union Station Project

THE GREAT railway mail terminal building, completed and put into operation on December 3 as a part of the Chicago Union station project, is in many ways a remarkable structure. It is of unusual size; the total cubic content is 8,715,000 cu. ft. and its eight floors if placed end to end would make a steel viaduct 75 ft. wide and more than a mile in length. Its construction involved the use of 7,500 tons of structural steel, 5,000,000 bricks and 32,000 cu. yd. of concrete. But the building is also of interest because of its occupancy. It houses some of the most complete and up-to-date equipment for the mechanical handling of materials, giving emphatic testimony to the enterprise and ingenuity manifested by the postal service and the railroads in meeting the requirements of the enormous volume of mail traffic which they are required to handle. The plant as now completed has an estimated capacity of 3,000 tons of mail per day with the employment of 1,000 mail clerks, porters and other employees. As a single noteworthy structural feature of the building may be mentioned a steel truss 149 ft. 4½ in. long, supporting a load of 4,050 tons. The truss itself weighs 365 tons, being the heaviest truss on record in building construction.

The mail terminal building flanks the east side of the south grid of station tracks in the new Union station terminal for a length of 796 ft., or the entire distance between Van Buren and Harrison streets. It is 75½ ft. wide and seven stories high, in addition to a basement under the entire structure.

The Two Level Plan Was Followed

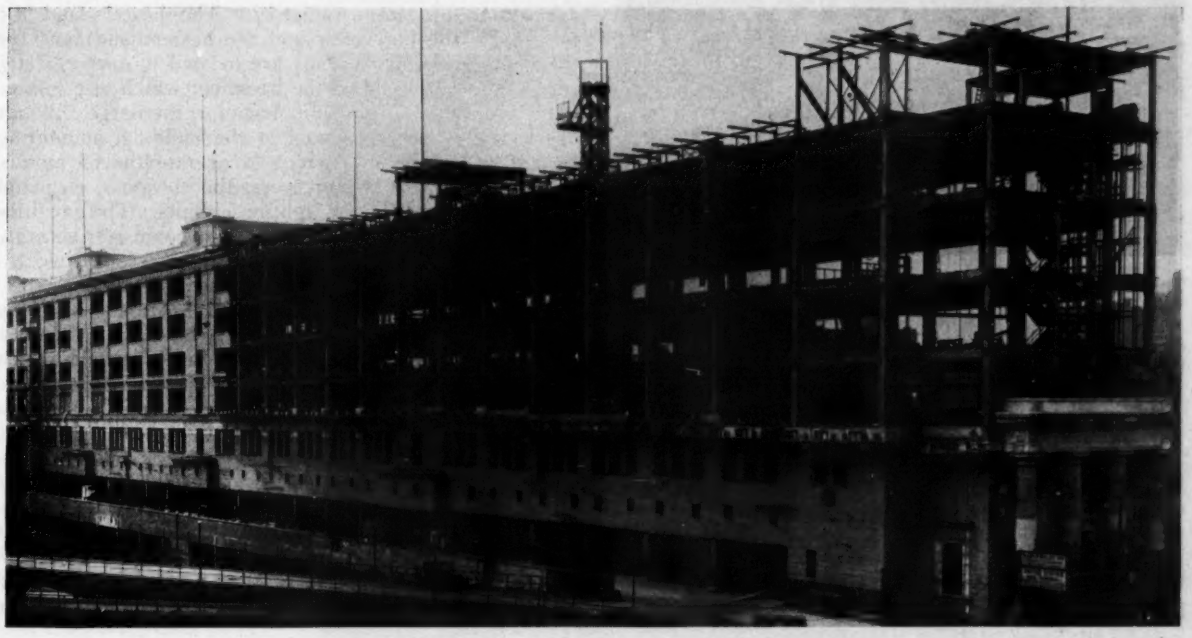
To afford separation of grades, the tracks at the Union station are on a level below the street, so that the three large freight terminals recently completed or under construction in this terminal area have all been carried out on the two level plan, being served by track platforms on the track level and by driveways on the street level to accommodate the street trucks. Communication between the two levels is afforded by elevators. This plan was necessarily carried out in the new mail terminal. The track level floor of the building is served by two stub tracks at each end of the building and two through tracks along the west side with suitably arranged platforms on a level with the car floors which will afford standing space for 61 cars when all track construction is completed. The street floor is flanked on the east side with a driveway 30 ft. wide running the entire distance between Harrison street and Van Buren street and served by 580 ft. of clear tailboard or enough to accommodate 60 street vehicles at one time. Backing-in space is augmented by setting back the tailboard 11 ft. 5 in. into the building at the driveway level. By means of tunnels under the tracks, leading from the basement of the building, access is had to all of the passenger station tracks



General Plan of the Station on the Street Level.

and the mail cars in trains standing on any one of them. Mail is handled between the basement, the track level and the street level by five elevators with 9 ft. by 18 ft. platforms of four tons capacity and a sixth elevator in the island platform between the two through tracks, that runs between the platform and the basement. Outgoing mail received at street level at the north end of the building is delivered to the track level or the basement through six chutes, each having three openings on the street floor.

The building has a structural steel frame encased in concrete with brick curtain walls. The foundations consist of concrete caissons carried to hardpan at a depth requiring about 50 ft. of excavation. They were constructed according to the so-called Chicago method requiring the excavation of maple sheathed wells from four feet to nine feet in diameter, which were filled solid with concrete as soon as the desired depth had been obtained. The foundations involved approximately 195 of these caissons and contained 6,700 cu. yd. of concrete and approximately an equal volume of excavation below the basement level. The load of the structural steel columns is supported on the caissons through the aid of I-beam grillages.



A Construction View of the Building from the East, Showing the Tailboard Space on the Driveway Level.

Heavy Steel Truss

The most interesting feature of the steel frame was the 149 ft. 4 in. truss required at the level of the street story in the west wall of the building to provide a space entirely free of columns in the track level story immediately below so that a crossover could be installed between a through track inside the building and one parallel to it just outside. The tracks are 23 ft. center to center and a crossover with No. 7 frogs required a length of 220 ft. between switch points. To provide a clear opening of 149 ft. necessitated the omission of four columns in the track level story so that the weight coming on these four columns from the upper floors, a total of 4,050 tons, had to be carried by the truss. In addition, as shown on the drawing, the end columns above the truss are offset 50 in. from the supporting columns, thereby introducing a heavy end shear which had to be resisted by the use of heavy web plate construction at each end of the truss.

The floor construction consists in the main of beams spanning longitudinally and transversely between the columns with three intermediate transverse beams equally spaced between the longitudinal beams. Considerable variation from the standard arrangement was required, however, to meet the special conditions encountered at the elevator openings and for the mail chute, conveying apparatus, etc. The offset in column locations also introduced some complications requiring the use of heavy girders in some portions of the floor framing.

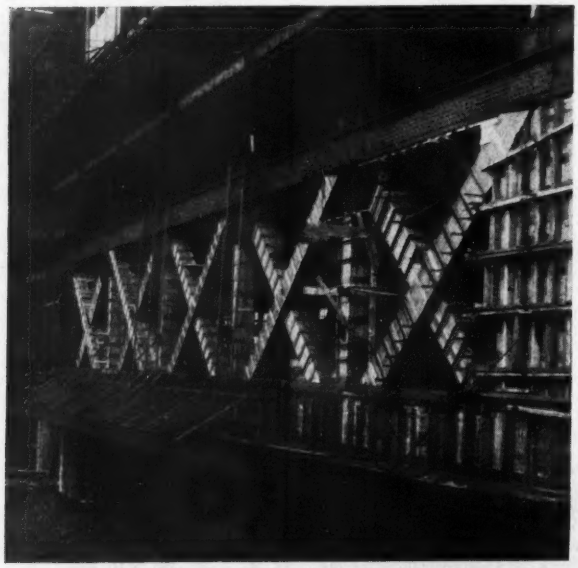
All of the steel frame is encased in concrete which was used also to provide the floor slabs supported by the floor beams. All of the floors in the building which are subject to any trucking are covered with creosoted blocks laid on a swabbing of pitch with pitch filler, there being upwards of 40,000 sq. yd. of this type of floor in the building. The blocks are all two inches thick except at the street level floor where 2½-in. blocks are used. The driveway is paved with creosoted blocks having a thickness of four inches. The portions of the building devoted to office purposes are floored with maple, while corridors, toilet rooms, cafeteria, etc., are provided with a special composition flooring installed by the Craig Company of Chicago as sub-contractors. Special floor construction is also provided for in the case of wooden platforms installed at the bases of the mail chutes on the track level floor and in the basement. These platforms are of wooden construction 30 in. high and floored with maple. The edges are protected with steel angles and wood bumping strips are also installed six inches above the floor level.

Large Window Areas

As seen in the photographs, the building has generous window areas. These are equipped with Fenestra steel sash, glazed with Solite glass. The area between the windows is occupied by brick curtain walls, finished on the outside with a cream colored face brick. The belt courses, cornice and other trim were treated with a light

colored terra cotta in a manner that gives a pleasing appearance. The portico at Van Buren street and the entrances at Van Buren street and Harrison street are of selected grey Indiana limestone.

On the track level, the entire west side and the north and south ends are open to the weather. The same condition holds true of the tailboard space on the street level except that the platform openings are equipped with Kinnear steel rolling doors.



The Big Truss As It Appeared With Forms in Place for the Concrete.

Ample Elevator Capacity

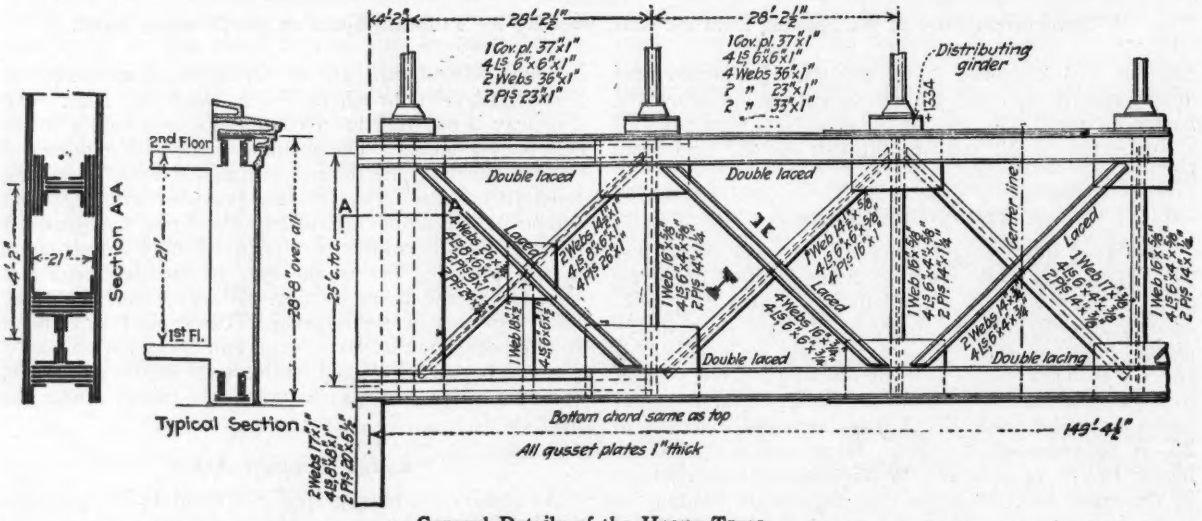
The elevators were furnished and installed by the Otis Elevator Company, Chicago, and are equipped with the micro attachment for automatically leveling the elevator when a stop is made at the floor, a very important feature in all cases where elevators are used in connection with trucking. In addition to the freight elevators previously mentioned, the installation includes three passenger elevators adjacent to the Van Buren street or main entrance to the building. Communication between the floors is also afforded by stairways enclosed in stairwells approximately at the quarter points and at the north and south ends of the building.

Unique Heating Equipment

The heating of the building entails a difficult problem owing to the fact that major portions of the two lower floors are not heated, being open to the weather. This involves such serious difficulty in arranging for the disposal of the condensation to be obtained from steam radiators on the floors above that it was decided to use a forced circulation hot water system. The water is heated by steam from a central power plant of the Union station in special heaters provided for the purpose and circulated through the agency of centrifugal pumps operated by steam turbines, two units being provided to insure continuity of service. The basement is provided with a combined heating and ventilating system supplying fresh air that is warmed by steam coils and delivered by Sturtevant fans. Enclosed offices at the track level are heated by steam radiators. The heaters and the pumps for the hot water and the heaters and fans for the hot air heating systems are located in a power station at the south end of the basement which also houses the electrical control equipment for the large amount of electric power consumed in the building, amounting to 500 kw. of direct current to operate the 65 motors required for the belt conveyors, the elevators, etc., and 400 kw. required for the lighting circuits. The facilities in the power plant also include a carbonic refrigerating plant to supply cold water for drinking fountains, together with the necessary pumps.

A number of platform scales are provided on the street level and track level with 5 ft. by 12 ft. platforms. These scales are all equipped with Weightographs which serve to project the correct weight in illuminant letters on a ground glass to a size that is read quickly and accurately.

The new mail terminal building was designed and constructed under the direction of J. D'Esposito, chief engineer of the Chicago Union Station Company, in cooperation with a committee appointed by the Postmaster General of which W. H. Riddell, general superintendent of the Railway Mail Service was chairman. The mail handling equipment was installed in the building by The Lamson Company, Boston, Mass. Graham, Anderson, Probst & White, Chicago, are the architects. The R. C. Wieboldt Company, Chicago, was the general contractor.



General Details of the Heavy Truss.

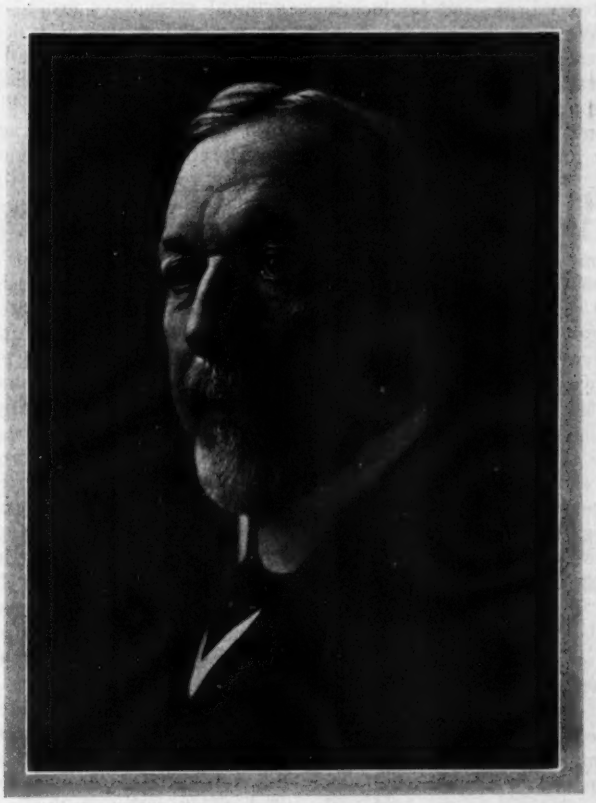
The Railroads of Today Need Men With Analytical Minds

An Interview With J. W. Kendrick, Whose Long Experience Enables Him to Appreciate the Greater Requirements of the Present

BY WALTER S. LACHER

"WHEN a railroad man says that he can readily hold any position in railway service, I am convinced at once that he is not thoroughly qualified to fill any position. No man can be considered entirely proficient in his work unless he realizes his shortcomings and studies constantly to overcome them and keep abreast of changing conditions in his field."

Coming from John W. Kendrick, chairman of the International-Great Northern, this statement carries much weight, because there are few railway men whose achievements have been more definitely related to close study. During the last 11 years he has devoted his entire time to investigations and reports on many railway properties here and abroad for the purpose of establishing the basis upon which banking interests have formulated plans for reorganization, financing and improvement. That some 56 of these reports have been made by Mr. Kendrick during the period in question testifies to the value placed by the bankers on such economic studies and the growing need for the application of scientific investigation to railway matters.



John W. Kendrick
Chairman, International-Great Northern

"When did you first conceive the need of applying analytical methods to transportation?" I asked him.

"It was while I was chief engineer of the Northern Pacific in the early nineties. My responsibility for maintenance of way matters placed me in constant touch with the operating officers of three independent districts of the property, and it became clear to me that their operations were not properly co-ordinated; that the way things were being done was not necessarily the right way. This led me to make a closer study of railway operation and as my viewpoint broadened, I came to the conclusion that the greatest opportunity for advancement lay in the operating end of transportation. I expanded my studies to include railway economics, the relation of grades to power and both to trainloads and allied subjects. This led to a study of the revision of grades on the lines of the Northern Pacific east of the Missouri river, as a result of which I concluded that an expenditure of $3,000,000 would result in a saving in operation on the basis of the traffic then handled, to the amount of $1,000,000 per year, or 33⅓ per cent."

"Was the work carried out according to your plan?"

"There was a long delay owing to inability to finance the project, but eventually all of the work was completed substantially as it had been originally proposed."

"But aside from any difficulty in financing, isn't it a fact that plans such as you proposed, based as they were on engineering studies, were not as readily appreciated in those days as they are today?"

"Yes, railroading in those early days was in too primitive a stage. With track laid with 56-lb. rail on a narrow roadbed without ballast, with light equipment and with limited traffic, the problems were entirely different.

"Organization for the management of the roads was much simpler in those days. There was also a closer contact between the employees and the officers as well as with the patrons of the road and the people along the line. As a boy I lived on a farm in Massachusetts that lay alongside the old Worcester & Nashua Railroad, at a point where the track was on a stiff grade. So I used to watch for the trains as they slowed up climbing the hill and often swung aboard the engine or caboose for a ride and a visit with the crew, who were all good friends of mine.

"In those days, the railroads were managed differently from what they are today. The officers were necessarily men who had gained most of their training in turning brake wheels and who had been 'smashed' regularly by the men above them and they, in turn, as soon as the chance came to them, 'smashed' everyone below them. Matters were settled on offhand judgment; cars and locomotives were purchased according to designs selected largely on the chance impression made by equipment seen on another road or on less reliable conclusions. There was not the same careful study of the relation of cause to

effect that prevails today. So, of course, the scientific study of transportation was then given little thought."

"Opportunities for the trained engineer, I suppose, were limited almost entirely to location and construction. Was that your experience?"

"I obtained my first experience in railway work in survey parties during summer vacations while attending Worcester Polytechnic Institute. I graduated in 1873 and three months later the country was engulfed in the great panic, so, like many other young engineers, I found it impossible to get into railway work. In fact, it was very difficult to obtain employment of any kind. I engaged in what temporary work I could find and for one year was employed as a common laborer in the wire mill of the Washburn & Moen Manufacturing Company, now a part of the American Steel & Wire Company. It was not until six years after graduation, in 1879, that I got my chance to get back into railroad work. In response to a telegram I went to the office of General George Stark, vice-president of the Northern Pacific in New York City, and was assigned to a party organized for location in the Yellowstone valley. We were instructed to proceed to Bismarck, N. D., where I arrived on August 10. From there we traveled by boat up the Missouri river to the mouth of the Yellowstone and thence up that stream to a point near Glendive, Mont., where our party started working east under military protection because Sitting Bull was then still at large. After running a line for some 30 or 40 miles we met a party coming west and then walked east over the line 190 miles to Mandan, N. D.

"A little later I was sent out over the line in a spring wagon to determine the waterway requirements for the various stream crossings and to estimate the amount of lumber required for the bridges and culverts. With the completion of this work I went out in February, 1880, as a transitman on location west of the Little Missouri river where we were still in hostile Indian territory and had the protection of a company of the Fifth infantry. It was very cold, averaging 15 deg. below zero for several weeks and with our limited camping equipment, it was an extremely hard experience. In June the party disbanded and I was given charge of 75 miles of construction east of Glendive. This mileage was extended from time to time until I was in charge of the grading on 175 miles of line."

It was here that Mr. Kendrick encountered a difficult problem calling for real initiative. At one point in the location along the Yellowstone, the line was supported along the face of a bluff that was being undermined by the river flowing along its base. So rapid was the erosion that the possibility of maintaining the track over a stretch of 1,500 ft. was despaired of and arrangements were made to build a transfer boat to serve as a ferry whenever slides caused a break in the track. After studying this problem, Mr. Kendrick conceived the idea of changing the channel of the river with the aid of a crib dam built on the ice and then sunk, and in spite of the fact that the original dam was breached, when repaired it served to divert the river to a slough on the north side of an island and overcame entirely the unstable condition which had defeated all efforts to construct a roadbed. The cost of this channel change was about $125,000, an expenditure which loomed so large in those days as to call for real conviction on the part of the man who was primarily responsible for it.

"In 1883," continued Mr. Kendrick, "I was appointed chief engineer of the St. Paul & Northern Pacific to take charge of the extension of that road over a distance of 60 miles from Sauk Rapids to Minneapolis, the development of terminals at Minneapolis and the construction of a line between the Twin Cities. A subsidiary of the Northern Pacific, this road had been acquired and extended as a means of getting into the Twin Cities, which had previously been entered over the tracks of the Great Northern. A short time later I was asked to take charge of the maintenance of way on 1,000 miles of the Northern Pacific in addition to my work as chief engineer of the St. Paul & Northern Pacific. Matters went on in this way until 1888, when I was appointed chief engineer of the Northern Pacific."

"Could you say more of conditions on the Northern Pacific at that time?"

"Money was scarce. The traffic on the Northern Pacific was extremely light owing to the unsettled condition of the country. The cost of construction had been heavy and great expense was incurred in replacing bridges and trestles, many of which were carried out by washouts after every freshet. Owing to the lack of experience with western streams, which are dry most of the time, but carry great torrents whenever it rains, many of the original waterways provided were inadequate. This, of course, was a typical experience on all of the original western railroads. We had 2,000 miles of 56-lb. rail and a great wealth of pile bridges. Because of inability to get enough labor to do all the grading, trestles were built in a great many places where embankments would have been preferable and the renewal and maintenance of these trestles, of course, added to the expense of operation.

"These were the conditions which confronted me in July, 1893, when W. S. Mellen, general manager, died and I was appointed in his place. My appointment, which preceded a receivership by only a few weeks, was followed by a period of great activity. Plans were prepared for marked reductions in expenses, including a cut in wages of 10 to 15 per cent, which I was able to carry out without evil consequences because I took the men into my confidence and gave them ample notice of the change. Later came the great A. R. U. strike of 1894 and other serious difficulties. But these were met successfully and with the rapid settlement of the country and the help of a reorganization effected in 1896, the road was finally in a position to go ahead with the grade revision plans, and secure the economies demonstrated by calculations made long before.

"In 1899, I was advanced to vice-president in charge of operation of the Northern Pacific and about a year later I received an offer from E. P. Ripley, the late president of the Atchison, Topeka & Santa Fe, to become operating vice-president of that road. About the same time I received an invitation from James J. Hill to go to the Baltimore & Ohio. I declined this offer, but 12 months later received another call from Mr. Ripley and, after declining this a second time, I reconsidered and entered the service of the Santa Fe on June 5, 1901. It was my good fortune to be associated with the Santa Fe during the period of its most extensive upbuilding. It had 8,000 miles of line when I joined it and some 10,000 when I resigned in 1911. During that 10 years we spent $152,278,114 for additions and betterments of which $87,440,435 was for road and $64,837,679 was for equipment. The net earnings increased from $22,211,878 in 1901 to $36,796,864 in 1911.

Mr. Kendrick's resignation was the occasion of a letter from Mr. Ripley, which merits attention, not only by reason of the warmth of feeling it discloses but because of the exceptional beauty of expression. A part of this letter is presented below:

"For ten years we have worked together for the rehabilitation of the Santa Fe—how successful, it is for others rather than for us to say. But we need not be

ashamed of the results and whatever measure of success has attended our efforts is very largely due to your thorough knowledge both of theory and practice, your originality in ideas, your zeal and your energy."

"How did you arrive at the decision to become a specialist in railway problems?" was a natural question.

"Much of my work on the Santa Fe was of the same onerous nature as that with which I had to contend during the later period of my service with the Northern Pacific. There were labor troubles and other equally trying problems, which engaged my attention so constantly that I was not afforded adequate relaxation. I had long entertained the idea that an intimate knowledge and experience in railway matters could be made valuable in the study and investigation of railway properties. Accordingly, I resigned in 1911 and was engaged shortly after for a trip by pack train up the Frazer river to Fort George in British Columbia for the purpose of determining the justification and feasibility of a railroad in that location, a proposition on which I reported adversely. My first investigation of an established property concerned the Wabash and since the presentation of my report on that road, I have been busy on work of a similar nature."

"The large number of reports which you have been required to make and the improvement programs that have proceeded as a consequence on such properties as the 'Frisco' and the 'Katy,' or more recently of the International-Great Northern, would seem to emphasize the marked change which has taken place in the attitude toward scientific methods in railway transportation. Current conditions present a sharp contrast to those of your early experience, so it would seem that there are a great many more opportunities for the man with a technical education today than there were in the days when you started with the railroads."

"That is very true, but the railroads have found it impossible to advance the wages of young technical men as fast as some of the other industries. Of course, the graduate who enters railway service must bear in mind that he is not at once able to do anything as efficiently as some fellow who has been carefully trained to do that particular thing during a long period of employment. The railroads also are confronted with the difficulty of having many of their best men hired away from them. I have often seen it happen and on one occasion it came to me personally. George Westinghouse asked me to become his European representative, but my interest was so definitely with the railroads (as it is now) that I declined the offer. I believe that the railroads offer a boundless field for development that must necessarily afford wide opportunities for the young man who will prepare himself for it."

An Organization For Laying Rail*

By W. E. Brown

Roadmaster, Chicago, Rock Island & Pacific, Fairbury, Neb.

IN THE preparation of this paper it has been assumed that the line on which the new rail is to be laid has been studied carefully by the division engineer and the roadmaster, that they have selected sections of well drained track on tangent where the short length rails are to be laid, that the excess distance of the outside rail over the inside rail on curves has been computed, that the number and length of the short rails needed in switches has been determined and that the rail has been loaded at the mills in such a manner that it can be unloaded continuously on the line without having to move the work train over the same territory several times to get the proper lengths and classes of rails unloaded at the right place. It has also been assumed that the foreman and the assistant foreman in charge of the work have been selected and their duties outlined to them thoroughly and that tools and equipment have been assembled in readiness to undertake the work. The organization described has also been based upon the assumption that from 30 to 50 miles of rail or more is to be laid on an important main line fully ballasted and carrying heavy traffic.

About the time that the material is beginning to arrive, an engineering party in charge of a first-class instrumentman should be assigned to this work to stake out the line of the track on both tangents and curves and to mark the station numbers on the rail for the guidance of the gangs distributing the materials. The degree of curves and the points of changing curvature on spirals and compound curves, should be marked, either on the rail or by means of stakes, for the instruction of the gangs curving the rails. As soon as the rail is laid this party should again go over the ground setting grade stakes for the surfacing gang.

As the material and particularly the rail begins to arrive, a gang of 15 or 20 men should be organized, under an experienced foreman and a capable assistant. This force should unload the rail and other materials, curve the rails for curves, line old track and score the ties. While this work is often performed by the regular section gangs, it is so important to the success of the larger rail laying gang that is to follow that it should not be left to these section gangs and passed from one foreman to another.

First quality full length rail should be unloaded as continuously as possible, taking into account the amount of rail of short lengths that is to be laid on tangents. Curves should be laid with first quality rail as should also the switches, except that where possible first quality rail of short lengths, selected to fit, unloaded in switches in preference to cutting rails of standard length. Short rails, depending on the quality, should be unloaded in pairs of even length inside of yard and station limits. Approximately two rails 12 to 18 in. shorter than the standard should be unloaded in each mile in order that they may be available when needed to equalize the joint spacing, as the rail on the one side will often gain on the other. Enough rails of similar length should be distributed evenly around curves to take up the excess length of the outside rail over the inside rail.

As the rails are being unloaded from the cars they should be placed workway on the ballast shoulder just below the ends of the ties and each rail butted up lightly against the preceding rail, taking care that the rail on one side is kept up lightly in the proper relation with the rail on the opposite side. The ballast shoulder just beyond the ends of the ties is usually sufficiently below the tie so that new rail will lie on the ground lower than the track rails and will not interfere with trainmen getting on and off cars. When laid in this position, rails can be picked up more readily than when they are farther out near the edge of the ballast. The cost of butting the rails together and placing them workway on the shoulder is

*This paper won the prize offered by the Chicago, Rock Island & Pacific to its roadmasters for the best paper on the laying of rail. Twenty-six papers were received in this contest.

practically no more than that involved in the promiscuous unloading and will save money.

The other track materials, angle bars, bolts, spikes, tie plugs, shims and rail anchors, should be unloaded on the edge of the embankment or on the shoulder of the cut. They should be unloaded in piles close together where they can be picked up without the necessity of doubling back, but they should not be unloaded promiscuously. They should be distributed in such quantities on each side of the track that it will seldom be necessary for a man to cross the track with material. The quantities to be unloaded in one place should be as follows:

Angle bars—20 in a pile on each side of the track at intervals of 10 rail lengths.

Track bolts—One keg at a place on one side as often as required.

Track spikes—One keg at a place on one side as often as required.

Tie plates—Piles of 100 on each side of the track as required.

Shims—On each side of the track as often as surface indications suggest their need.

Rail anchors—A sack in a place as often as it is estimated that they will be required.

Tie plugs—A bundle of 500 on each side of the track, 700 ft. apart on the line side and 350 ft. apart on the opposite side of the track.

As the material is being received there are often times when this gang will be required to wait for material to arrive for periods ranging from an hour to several days. During this time the line rail of the old track should be put in first-class line. The inside rails of curves of over one degree and the outside rails of curves of over two degrees should be curved; all ties should be scored and everything done to avoid delay to the steel gang.

As soon as sufficient material has been unloaded to warrant starting the steel gang, a gang of from 45 to 50 men and a timekeeper should be organized under the supervision of an experienced foreman and two experienced assistant foremen. This force should be furnished with a rail laying machine or a gasoline propelled hoist. The distribution of the men in this gang should be about as follows although there is so much difference between the conditions on various pieces of track that some shifting of men will undoubtedly be necessary.

Under One Assistant Foreman

5 men with rail laying machine.

3 men pulling spikes and making connections to allow for passage of trains.

7 to 12 men adzing and throwing out old rail, this number varying with the amount of adzing necessary.

2 men placing and driving tie plugs.

2 men flagging.

1 man applying expansion shims and taking temperatures.

Under the Second Assistant Foreman

4 men applying rail joints and bolts.

12 men spiking, gaging and holding and applying tie plates.

4 men shimming and applying rail anchors.

4 men trucking and distributing tie plates and other material.

1 man carrying water.

The foreman should not be tied down to any individual assignment but should be free to go from one part of the work to another, observing his gang and redistributing his men and seeing that all work is performed properly.

On high speed ballasted track the rail should be laid with broken joints and great care should be taken to prevent one rail from gaining over nine inches on the other and leading to improper tie spacing. The line rail should be laid first and only the spikes on the inside of the rail should be pulled, except where it is necessary to remove the old tie plates. Before the opposite rail is laid, the line rail must be in perfect line or poor gage will result. The temperature of the rails must be tested at frequent intervals and the proper expansion allowance made for each rail when laid. I prefer hardwood expansion shims to metal. Rail anchors should be placed in temporary position on each rail as laid and enough anchors applied to insure that the rail will not creep in either direction. When laying rail the joint ties should not be spiked unless they are spaced carefully and square across the track, except where immediate spiking is necessary to insure safety. No tie that is not square across the track should be spiked for poor gage will result.

Every tie that does not have a full bearing should be shimmed and the speed of trains should be restricted to not more than 20 miles per hour over newly laid rail until the track is surfaced. Whenever it is necessary to cut a rail this should be done by sawing.

Whenever possible the work should be closed up in the evening with both rails laid to as nearly the same point as possible. Taper rails should be used in making connections over night and offset continuous joints in making connections in the day time, where heavier rail is being laid.

Switches should be laid as the gang comes to them. At such a time the gang should be divided about evenly and the men not required in laying the switches should be sent back to complete the back spiking and to retighten bolts. Angle bars and bolts should be oiled before applying them. Following the steel gang the section forces should disconnect the old rail, pick up and load all material and scrap and load the old rails.

A surfacing gang consisting of a foreman, an assistant foreman, a timekeeper and from 50 to 75 men, depending on the kind of ballast to be handled, should follow as close as possible behind the rail gang. This force should surface the track, space and straighten ties, apply new ties where needed, remove shims, complete the spiking, fill in and dress the ballast and apply the rail anchors in their proper position after the ties have been spaced.

Only a light surface of perhaps two inches should be made to a staked grade line. A high raise of from six to eight inches on new rail is a mistake, in my opinion, and will ruin the rail, as the tamping under high raises is more uneven than under light raises. It is necessary, however, to make a raise of approximately two inches in order that the ties can be spaced. During the year following the laying of rail it is essential that a good sized section force be maintained so that all loose ties can be tamped as soon as this condition becomes evident for this will contribute much to the life of the rail.

No Car Shortage Here

A Group of Students Applying for Their First Naturalization Papers.

Is Educational Work Worth While?

Carefully Systematized Efforts in This Direction Lead One Road To Endorse Such Activities Heartily

DURING the last few years the Chicago, North Shore & Milwaukee has been carrying on a rather unique and decidedly interesting work in its maintenance of way department in the form of an educational movement among the track forces. Unlike many educational movements among workers, regular schools have been established where the men are gathered in classes at regular intervals and are taught how to speak, read and write in the English language as well as

One of the Class Rooms

about American ways and about the railroad on which they work. Nor is the work limited to these schools, for, in addition, courses of instruction are given for foremen and those who care to become foremen, and social gatherings are provided in which the workmen and their families meet together in wholesome recreational activities. In the opinion of the management the experiment has proved very successful. The foreign workers have entered into the spirit of the work, and the company, originally skeptical, considers itself well repaid in various ways for the attention given this subject.

The Work Began as an Americanization Program

The work was undertaken about two years ago as an Americanization program. The need for something of this kind suggested itself during the war. There were then employed in the neighborhood of 200 trackmen. As on other roads, these men were almost all of foreign birth and all of foreign parentage. Altogether 14 nationalities were represented with Croatians and Italians predominating. As usual they were hired through labor agencies. During the war the attention given to selling liberty bonds to these men and to scrutinizing them in the interest of the government disclosed that they were living in a decidedly un-American atmosphere and were harboring un-American ideas to an alarming degree. It was apparent that little in the way of improvement was being accomplished by the customary practice of working through foremen and labor agencies and that something should be done to overcome the old world ideas which these men entertained about their work and their relations with their employers.

As an initial step in this direction the practice of keeping labor in boarding camps maintained by contractors was replaced by a system of company camps constructed and maintained to attract the better class of men and keep them contented. An improvement was made in the commissary, baths were provided, close attention given to fumigation and finally a Y. M. C. A. secretary was employed to look after their recreation.

While this work was in the right direction it became increasingly evident that what the men needed was Americanization and after some hesitation it was decided to

encourage and by a systematic course of education to assist these foreign born employees in becoming citizens. To this end a committee was selected, composed of four officers of the maintenance of way department and four foreign track foremen to coöperate with and to advise the Y. M. C. A. secretary in carrying forward the work.

As a first step in the program a complete survey was made to ascertain the educational and citizenship needs of these men. This survey revealed some startling figures. Among other things it was disclosed that while more than 88 per cent of the men have been in this country over five years, 90 per cent were not citizens and the remainder had only taken out the first papers. The survey showed further than over 30 per cent of these men, whose ages ranged from 18 to 60 years, and averaged 36 years, could not speak the English language, 75 per cent could not read it, and 80 per cent could not write it, while 25 per cent could not even read or write in their own language. The problem, therefore, was one of planning a course of instruction to meet the varying requirements of the men and which at the same time would not be looked upon with suspicion by those receiving the instruction and which could be made accessible to all regardless of the place of their employment. As carried out the plans involved putting up classrooms at convenient points along the line where all gangs could meet on local trains passing their houses. In all about six classrooms were provided, the one illustrated being in an abandoned freight house.

Teaching the Men English

The first step of instructions was that of teaching the men English. For this purpose Roberts System of English for Foreigners was selected, it being a course of study requiring no interpreters nor any reference whatever to the students' native tongues. Briefly, the system consists of placing a series of words on a sheet of paper, with a sentence opposite each word to show how the word is used. On the back of this sheet each of the sentences found on the front is printed to show how it appears when written in long hand. The following is a sample of such a sheet:

Writing a Letter

take	:	I take a sheet of writing paper.
dip	:	I take the pen and dip it into the ink.
write	:	I write the letter.
sign	:	I sign my name to the letter.
dry	:	I dry the wet ink with the blotter
fold	:	and fold the letter.
take	:	I take an envelope.
write	:	I write the address on the envelope.
clean	:	I clean the ink off the pen.

The instructor, by means of his voice, shows how the word sounds and explains its meaning by going through the proper motions. For example, when teaching the word "drop," the instructor points out the word on the paper, pronounces it and then drops something so that the student can connect the sound of the word with the motion indicated. To promote the interest as well as enlarge upon the value of the work to the men, attention was given to tying the instruction up with track work and as a method of keeping the study from getting tiresome use was made of motion pictures at these classes. As the work progressed, English was supplemented with simple courses of study in grammar, government and arithmetic, and here, as in the case of English, the instruction was associated with the work the men were actually doing. For example, in arithmetic, a problem would be given as follows: If 350 ties are unloaded for renewals in track and 85 ties have been renewed, how many ties are left?

Beginning late in 1920, two hourly classes were held on two evenings of each week, excepting for two months during the summer, when the program was confined to pictures and recreational pastimes. Instruction was rendered voluntarily by men in clerical and supervisory positions in the service of the company, and all study was conducted on the men's own time. Early in the campaign it developed that not every foreigner was willing to take up this training, and it was thereupon decided to require all men to attend on the ground that it was advisable from a safety standpoint for all men working on track to have some understanding of English, and foremen were instructed to keep in their gangs as far as practical only such men as could read and write English and were willing to attend schools provided for them. The order had a good effect upon attendance to classes, bringing a number of men into the school who had previously shown no interest, and while it necessitated discharging a few men, it does not appear that those remaining entertained any bad feelings over this order.

Much Interest Was Displayed in the Work

Almost from the start a great deal of interest was taken in the work and creditable progress was made by the men in their studies. As indicating the interest taken in the work by some, one man over 40 years of age, who though many years in this country had not learned the language, said to an interpreter at the close of the first lesson, "I would rather learn English than to have $1,000." Even the men who could not read in their own languages began early to make progress in reading and writing English, and the progress was such that a day in May was selected as "first paper" day, upon which all foreign employees on the road who had not yet declared their intentions to become American citizens, could do so. When the day arrived (May 19), every court house from Chicago to Milwaukee was visited by groups of these men, the day being made quite an occasion. As a result of this, the number of employees not yet having declared their intentions to become citizens dropped to 27 per cent, of which six intended going back to Europe, nine did not as yet understand, and seven refused.

A Foreman School Was Instituted

So successful did the work of the English class progress, that it was decided not only to continue these classes, but also to establish a school for foremen and all who desired to become foremen. As a matter of fact a survey showed that some of the foremen were almost as much in need of the training as the men under them, and instances were recalled where foremen had been discharged for disobeying instructions, which, as it was found out later, through ignorance, they did not understand. These schools are conducted in the form of a club at which lectures are given on methods of maintaining track. The men are not required to study lessons, but it is required that all foremen send in answers to series of questions discussed in the lectures given them. In addition to studies in track methods, foremen also discuss in these club meetings the relation of capital and labor as well as other subjects pertaining to the railroads and their relation to it.

As an example of the method of instruction, the following portion of a lecture is reproduced below, together with a list of examination questions covering this subject.

Lecture on Drainage

Definition—Drainage is the provision by which surface water is drained from the roadway and the track structure supported by the roadway.

Importance—The importance of drainage in good track maintenance cannot be overestimated, as may be best shown by considering the evil effects resulting from improper drain-

age. These evil effects are most noticeable in a territory which has a soil such as that along the North Shore where there are no natural provisions for drainage, but where all such provisions must be made by the road builders. In many soils, such as gravel and the like, nature provides her own drainage and it is not necessary that the road builders give this subject the attention that is required here, but where the subgrade is of an impervious clay such as we have practically the whole length of our line, it makes the subject of drainage of paramount importance, and it will be well to consider the evil effects of improper drainage in detail.

Improper Drainage—When water is allowed to stand upon clay soil it so softens the material that it will run like jelly. If a track is laid on this softened clay soil and trains are run over the same, the impact of the moving trains pounds the ballast down into the softened clay and forces up the jelly-like substance in between the stones comprising the ballast, thus fouling the ballast and rendering it impervious to water, making the ballast of the nature of a gravelly loam soil instead of a solid porous substance. This, of course, will go on more in one place than in another, as clay does not soften uniformly under water, and there will be places that have better drainage than others. The result of this is that the track settles out of line and surface not uniformly, giving us our rough riding track. This un-uniform settlement produces excessive strain on the rails, resulting in bent or broken rails, and as the joint is the weakest place in the rail structure the settlement here is the greatest, producing what is known as low joints.

Questions on Drainage

What do we mean by track drainage?
Name four bad effects of improper drainage.
What do we mean by "sub-grade"?
Why is drainage more of a problem in our clay soil than in most soils?
What are the different ways by which we get drainage?
Which one of these ways is most important on your section? Tell why.
Where is the poorest drained spot on your section?
Name the evil effects which show here?
What methods would you suggest to remedy the drainage in this particular spot?
Why is poor track drainage a hindrance to the best safety?

Aside from showing how the foremen grasp the instruction given, their answers show a decided proficiency as having been acquired by some of them in writing English, a result which in many cases was partially due to the assistance given by their children.

The Work Has Been Very Successful

At the present time the Americanization program and the larger educational program into which it has grown have been conducted for two years and have proven very successful both from the standpoint of the men and the railroad. The carefully systematized instruction given the track men in the classes, supplemented as it is by family gatherings, has gone a long way not only to enlarge his interest in the work he is doing, but also to readjust his viewpoint concerning American institutions, and while much of the benefit to the railroad is not measurable it has plainly been beneficial from a safety standpoint, has materially reduced the labor turnover and minimized labor difficulties.

All of the schools are now grouped at two locations and it is the intention of the management to continue the courses and thus maintain the close contact with these men which is possible in such a work. The work is carried on under the jurisdiction of J. S. Hyatt, engineer maintenance of way, to whom we are indebted for the above information.

Railroad Developments During 1922

THE YEAR 1922 ended under conditions that were far better from both a construction and an equipment standpoint than the railways have experienced since the beginning of federal control. Although the number of miles of new first track constructed during the past year was near its record low figure, with the mileage of lines abandoned still in excess of that built, a much healthier condition of railway construction work was evidenced. In the equipment field the railways ordered more freight cars than in any year since 1912, more passenger cars than since 1916 and more locomotives than since 1918, while at the same time they experienced the largest car shortage in their history. Financial conditions were much more sound than they have been in the previous several years and this was reflected in the construction work which the roads carried out during the year. Many new projects were started and considerable work was also done in the rehabilitation of such physical properties as bridges, etc., along with the construction of such facilities as were needed to maintain and improve operation. The budgets for 1923 indicate a greatly increased program of expenditures for roadway and equipment that may exceed the average for the last ten years with the possible exception of 1917.

New Lines Constructed and Lines Abandoned

During 1922 only 324.09 miles of first track were built in the United States, as compared with 475 in 1921, 314 in 1920 and 686 in 1919. The total completed mileages of first, second, third and other multiple tracks were 542.63 in 1922 and 642 and 414 miles in 1921 and 1920, respectively. This is some decrease from the mileage built in 1921 and is chiefly in first track mileage. One important increase was evident, namely, the amount of second track constructed during the year, the figure reaching 195.97 miles as compared with a mileage of 143.07 in 1921 and 90.87 for 1920.

Canadian mileage of new track still reflects the unsettled railroad conditions of that country, only 144.50 miles of new first track and no multiple track being built during the year. This is very close to the low record of 135 miles for 1918. Such building of new lines as was carried out was done by the Canadian Pacific in furthering the completion of some of the branch lines it had had under way for a number of years; and by the Temiskaming & Northern Ontario, which completed slightly over 44 miles of its 70-mile extension north from Cochrane. Much has been written in the past of the large mileage of the Canadian National Railways, a large proportion of which traverses territory that in its present, and probably for some time to come in the future, state of development is more than adequately served by railway trackage. Considering this, it is interesting to note that this system constructed only 1.48 miles of track in the past year. The Canadian Pacific still has some branch line work under construction which will probably be completed during 1923. The Temiskaming & Northern Ontario, mentioned above, will complete the remaining mileage of its 70-mile extension during the next year and has a new line under survey from the end of the present extension, to Moose Factory on James Bay, about 110 miles further north.

The only state in which any outstanding mileage was constructed was Kansas, within which there were built 70.74 miles of first track and 12.80 miles of second or a

total of 93.54 miles. In addition to that about 100 miles or more of new first track is under construction in that state which will probably be completed during 1923. The only other states which had any mentionable mileage of first track alone were California with 36.85 miles, Oklahoma with 39.68 miles and Utah with 32 miles. Illinois contained more diversified track construction than any other state, largely the work of the Illinois Central, having 15 miles of first track, 21.27 miles of second and 14.69 and 4.83 miles of third and fourth tracks, respectively, or a total of 55.79. The largest amount of second track laid was built by the Great Northern, 30.95 miles in Washington and 11.55 miles in North Dakota.

Large Expenditures Authorized

In construction other than track there was a large amount of work on the replacement, strengthening and reconstruction of bridges, etc., the building of enginehouses, machine shops and other terminal facilities, some grade separation, additional main tracks, and grade and line revision. While the number of large projects started during the past year was limited, work was started on several involving large expenditures. Among the largest undertakings is that of the New York Central at Castleton, N. Y., where a new high level bridge is being built across the Hudson river, with new freight terminal facilities, connecting trackage, etc., which, when completed, will cost in the neighborhood of $20,000,000. Work was also started on the new union passenger station of the New York Central lines and the Nickel Plate at Cleveland, while the Pennsylvania resumed work on its improvement program at Pittsburgh. The Santa Fe authorized an expenditure of $6,500,000 for 75 miles of second track in Arizona, while the Louisville & Nashville opened an improvement program designed to increase the capacity of its lines serving the Kentucky coal fields, involving an expenditure of $26,900,000. The Union Pacific authorized a number of terminal projects, new lines, etc., aggregating a large sum of money, while the Erie has been pushing the construction of new locomotive repair facilities at Hornell, N. Y.

The gradual weeding out of the unproductive lines through abandonment continued through the past year, although considerably less than that for 1921. During 1922 a total of 221.70 miles were abandoned entirely and track taken up and 455.07 miles were abandoned on which the track has not yet been taken up. The first figure is about on a par with that for the past two years and about one-half or less than that of 1918 and 1919. The mileage abandoned and not taken up was about one-fourth of that for 1921 and in general, somewhat less than the preceeding three years. The majority of the mileage abandoned was so-called short lines covering either the entire mileage of the line or in many cases, the remaining mileage of other short lines where abandonments were made either in 1921 or the year previous, Only two short lines of any size were abandoned during the year, namely the Dayton, Toledo & Chicago and the Duluth & Northern Minnesota with 90 miles and 99.25 miles of track respectively.

1923 Budgets Show Large Appropriations

From statistics furnished by 27 railways with an aggregate mileage of approximately 95,000 miles, already having budgets authorized for over $350,000,000 for improvements to roadway and structures and for new equipment during 1923, it is estimated that approximately $700,000,000 will be spent by the railroads during the coming year. This money will be utilized for new lines, for second track, for new yards and terminals, for freight and passenger stations, for shops and shop equipment, for signalling, for cars and locomotives and for other facilities which go to make up railway property. Somewhat typical of the 1923 outlook for greatly increased expenditures for roadway and equipment are the budgets of such roads as for instance, the New York Central with $29,000,000 for roadway in addition to $54,000,000 for equipment to be delivered this year, the Pennsylvania improvement program aggregating $55,000,000, the Illinois Central whose budget totals over $42,000,000, the Louisville & Nashville which carries over approximately $20,000,000 for 1923, the Norfolk & Western, $32,000,000, and the Union Pacific with $20,000,000.

Signal Construction Shows Improvement

The past year has witnessed greater activity in automatic block signal construction work than any year since 1918. A total of 1,503 miles of block signals were installed in the United States during 1922, of which 1211 miles were automatic block. In Canada during the same year 43 miles of road was equipped with automatic signals. Part of the mileage constructed represents new work and a portion represents reconstruction and replacement. In comparison with 1921 there has been a decided increase in construction work as the total block signal mileage completed in the United States and Canada during 1922 was 1546.6 as compared to 824 miles in 1921. Because of the recent order of the Interstate Commerce Commission automatic train control will be the outstanding feature in the signal field on a number of railroads in the United States during 1923.

The Car and Locomotive Orders

The number of freight cars ordered during the past year was 179,854, for service in the United States, 746 for Canada and 1,072 for export. The number of freight cars actually built was 66,252. In comparison with 1921 there has been a tremendous increase in freight car orders, the number being in excess of any year since 1912. Freight car orders for 1921 totaled 23,346. The average annual orders for the nine years ending with 1921 were 92,216. Passenger car orders showed also an increase over 1921 and as far back as 1916, 2,378 passenger cars having been ordered for service in the United States, 93 for Canada and none for export. Only 246 were ordered for use in the United States in 1921. The number of locomotives ordered for use in the United States was 2,534 as compared with 239 in 1921. This number is in excess of the average yearly orders for the preceeding nine years which were 1,889. Orders placed by railroads in Canada with Canadian builders totaled 42 as compared with 35 in 1921 and 189 in 1920. The export business in 1922 was largely conspicuous by its absence. Only 129 locomotives were ordered for export as compared with 546 in 1921 and 718 in 1920; this is the smallest figure which has been reported since tabulated records of export orders were kept by the Railway Age beginning in 1915.

This buying movement was first in evidence in April, but did not assume any volume until July. By far the larger part of the year's business was placed in the last six months of 1922 and in this period practically every railroad came into the market and placed fairly large orders for new motive power. A noteworthy feature was that the buying continued in volume through months when under normal conditions there is usually a slight falling off. It similarily seemed to be unaffected by such adverse factors as the coal strike and the shopmen's strike both of which had severe effects on net earnings.

Promoting the Art of Making Good Concrete*

Rich Mixtures Are Better—Each Additional Sack of Cement Per Cubic Yard Adds About Five Hundred Pounds per Square Inch to the Strength of Concrete

BY D. A. TOMLINSON
Manager Railways Bureau, Portland Cement Association, Chicago

AGGREGATE is inert. Concrete hardens because of reactions between Portland cement and water. The quantity of mixing water and the quantity of cement both affect the strength. In fact, the controlling factor in the strength of concrete is the ratio between the volume of mixing water and the volume of cement. As long as concrete is workable, the lower the water-cement ratio (w divided by c), the stronger will be the concrete. This ratio can be reduced in three ways, viz.:

1. By reducing the quantity of mixing water.
2. By improving the grading of the aggregate.
3. By using more cement, i.e., a richer mix.

Obviously, then, the quantity of mixing water should always be as small as will give the consistency required for the work in hand. "Less mixing water means stronger concrete" holds true over the range of consistency that can be used in construction work. When the mixture is too dry to be workable, further reductions in the water content decrease the strength. To increase the strength still more, or in other words to reduce the water-cement ratio further and still have a workable mixture, it is necessary to use more cement.

Improved grading of aggregates reduces the quantity of mixing water required to obtain a given consistency. Larger, better graded particles find their way into place more easily and require less mixing water. In general, coarse sand and large pebbles require less mixing water than fine sand and small pebbles. As long as the aggregate is not too coarse for the mix (proportion of cement to total aggregate), the coarser the aggregate the smaller will be the quantity of mixing water necessary for a given consistency, therefore the smaller the water-cement ratio and the stronger the concrete.

Assuming a given consistency, which should always be as stiff as the nature of the work permits, and well graded aggregate, the strength of the resulting concrete depends on the amount of cement, i.e., on the mix. An increase in the amount of cement reduces the water-cement ratio, because a rich mix will attain a given consistency with less mixing water per sack of cement than a lean mix. If less mixing water per sack of cement is not used with a richer mix the value of the additional cement will be lost.

Tests made at the Structural Materials Research Laboratory, Lewis Institute, Chicago, clearly bring out the increase in strength resulting from the use of richer mixes. Typical results are given in the table. The same aggregate, with a fineness modulus of 5.75 and graded up to 1½ in. in size, was used in all tests. The cement was a mixture of equal parts of four brands purchased on the Chicago market. The relative consistency of all specimens was the same, 1.10, with a slump of three to four inches. This consistency is suitable for most construction work. All tests were made at the age of 28 days. Thus the increase in strength was due solely to increases in the quantity of cement.

Increased Strength From Richer Mixes

These data are plotted in the chart. Other consistencies, gradings and ages give different curves, but they are all of the same general form and show a similar increase in strength for the richer mixes. To save space the figures for neat cement and a 1 : ⅓ mix were omitted from the chart. To have included them would have doubled its width.

Ordinary concrete (1 : 3½ : 7 to 1½ : 2) contains from 3 to 8 sacks of cement per cubic yard of concrete. Note that within this range the strength of concrete increases in direct proportion to the cement.

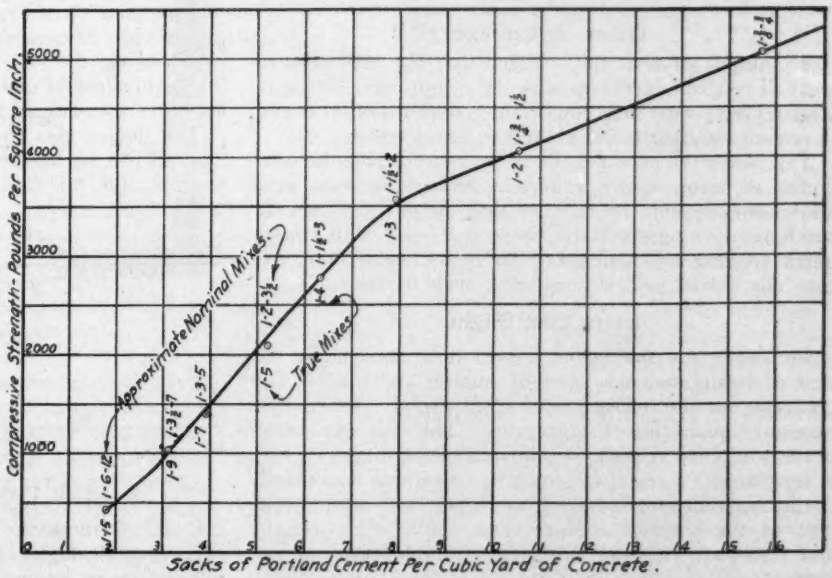


Chart Showing Effect of Quantity of Cement on the Strength of Concrete

Each additional sack of cement per cubic yard adds about 500 lbs. per sq. in. to the strength.

Increasing the cement content from 2 to 4 sacks per cubic yard adds 200 per cent to the strength of concrete. Increasing from 3 to 6 sacks per cubic yard adds 150

*The third of a series of articles on the principles of making good concrete.

per cent to the strength, and increasing from 4 to 8 sacks per cubic yard adds 133 per cent. In other words, doubling the amount of cement considerably more than doubles the strength of concrete.

With mixes richer than 1 : 1½ : 2 the increase in strength is not so rapid but it is still directly proportional to the quantity of cement. Above 8 sacks of cement per cubic yard of concrete, all the way to neat cement, each additional sack of cement adds about 140 lbs. per sq. in. to the strength of concrete.

Effect of Quantity of Cement on the Strength of Concrete

True Mix*	Approximate Nominal Mix*	Sacks of Cement per Cubic Yard of Concrete	Compressive Strength, lb. per Sq. In.
Neat	.....	29.7†	6630
1: ⅛	.....	23.0	5720
1:1	1: ⅜: ¾	15.7	5070
1:2	1: ¾:1½	10.5	4070
1:3	1:1½:2	7.9	3570
1:4	1:1½:3	6.3	2760
1:5	1:2 :3½	5.2	2090
1:7	1:3 :5	3.9	1400
1:9	1:3½:7	3.1	1030
1:15	1:6 :12	1.8	440

*The true mix is the ratio between the volume of cement, expressed as unity, and the volume of total aggregate after the fine and coarse have been combined. In the nominal mix, which is the one ordinarily used, the volumes of fine and coarse aggregate are expressed separately. The nominal mix can readily be converted into the true mix because for the usual proportions of fine and coarse aggregate (fine aggregate 20 to 70 per cent of the total) the volume of combined aggregate after mixing is about seven-eighths of the sum of the volumes of fine and coarse aggregate measured separately. Because of this shrinkage a 1:3:5 nominal mix does not give a 1:8 true mix as sometimes assumed, but about a 1:7 true mix.

†The volume of concrete obtained from neat cement depends on the quantity of mixing water used. For water-cement ratios between 0.3 and 0.6, the volume of concrete obtained from one sack (one cubic foot) of dry cement equals 0.5 of a cubic foot plus the amount of water used. In the example given here the water-cement ratio was 0.4 and the shrinkage was therefore about 10 per cent.

Other Advantages

Thousands of tests have shown that the resistance to wear of concrete increases with the compressive strength. Resistance to wear is an important consideration in floors, pavements and platforms subject to heavy traffic.

The richer the mixture, the more impermeable the concrete. A porous concrete may be injured by frost, may allow objectionable leakage, or may permit moisture to reach reinforcing steel and cause corrosion with consequent spalling and damage. An impermeable concrete, carefully placed, will be free from such troubles.

Extra Cost Slight

Increasing the amount of cement does not change the cost of forms, nor the labor of mixing and placing the concrete, nor the overhead costs. It slightly reduces the necessary quantities of aggregates. The only extra cost is the additional cement. Compared to the total cost this is very small. Even if the quantity of cement is doubled, the increase in cost is only 5 to 15 per cent of the total cost of the concrete. More than double the strength and resistance to wear and greater durability at an increased cost of only 5 to 15 per cent is surely an excellent investment.

In structural concrete, increased strength may permit the use of higher stresses with a consequent reduction in section and lower total cost. In floors, platforms and pavements, increased strength and resistance to wear means greater value and better service. Even in mass concrete where mass and weight are required rather than strength, increased resistance to the attacks of frost and other destructive agencies make a rich, impermeable concrete desirable. Remember that with the usual mixtures, each additional sack of cement per cubic yard of concrete adds 500 lbs. per sq. in. to the strength of the concrete.

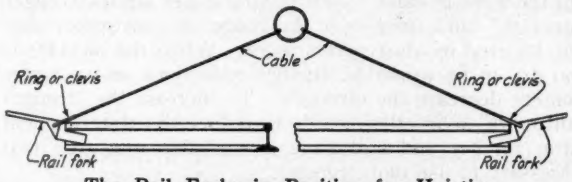
A Method for Handling Rails

By J. J. Hess

General Roadmaster, Great Northern, Seattle, Wash.

In the accompanying illustration is shown a simple device for handling rail which has been found to be an improvement over any other method which we have used or known. This device consists of two rail forks so designed that each can be applied easily and quickly to the rail and as easily and quickly removed while the rail is on the ground and yet so connected to a hoisting cable that when the slack in the cable is taken up, the rail forks engage the rail so snugly as to avoid any possibility of their slipping. There is thus little or no chance for an accident to occur.

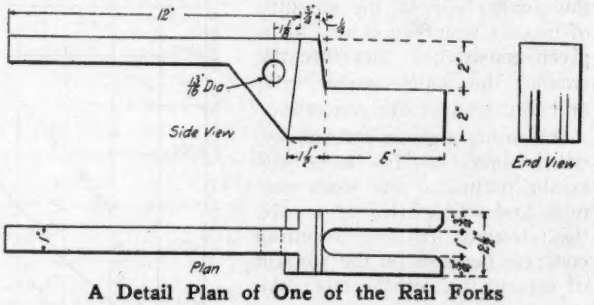
In addition to promoting safety in handling rail, the device in also a decided labor saver. The old method of loading rail by means of a rail tong attached to a hoisting cable required three men on the car, three men on the ground and an additional man to straighten up the rail workways. This method also required the time of two men with tape lines to measure and mark the center



The Rail Forks in Position for Hoisting

of the rail at which to attach the rail tongs. Compared with this method the new device eliminates the time of one man on the car in handling the tongs and the time of one man on the ground for the same purpose and appreciably reduces the time of the three men required in adjusting the rail workways and marking its center. The equivalent of one man's time may be taken as a conservative estimate of the saving in labor.

The device also speeds up train service inasmuch as the rail can be handled more quickly through the ability to apply the rail forks regardless of the position of the



A Detail Plan of One of the Rail Forks

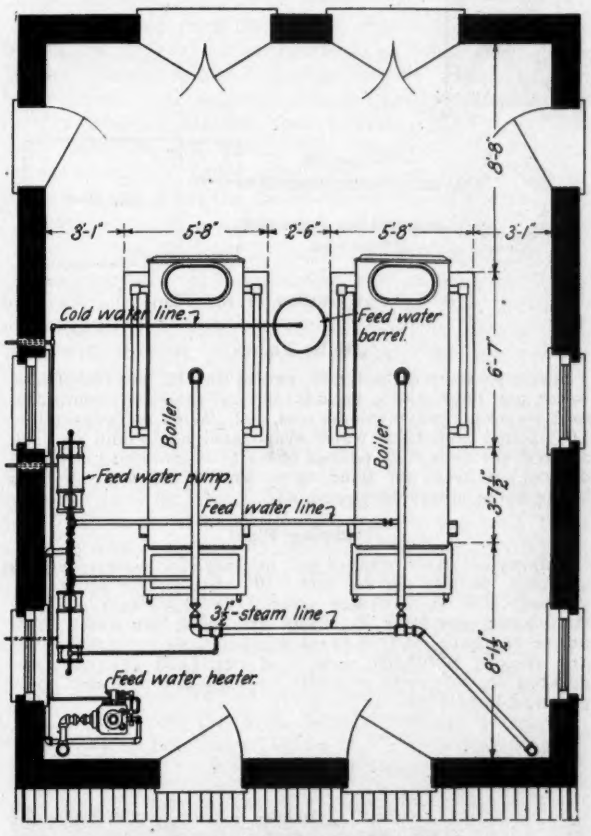
rail and through the practical impossibility of accident occurring through slipping of the rail tongs. At the present wage scale the daily saving in labor may be taken as $9.60 which, added to a 20 per cent saving in train service, gives $15 as a conservative saving afforded by the use of this device over the old method. As a further feature of this device, there in also to be considered the fact that the application of the rail forks at each end eliminates the trouble from swinging encountered when hoisting the rail by tongs applied at the center.

An Economical Water Supply Plant

Wide Range of Water Levels in River Introduces an Interesting Problem in Pumping Station Design

By WILLIAM C. RUDD
Assistant Engineer of Water Supply, Louisville & Nashville, Louisville, Ky.

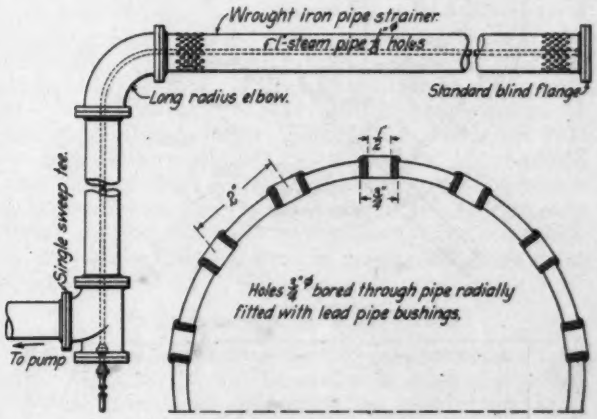
IN JULY, 1917, the Louisville & Nashville began the operation of its large yard and terminal at DeCoursey, Ky., which are located about seven miles south of Cincinnati, on the Kentucky division, and are used as the terminus of northbound freight movements, the major part of the tonnage consisting of coal brought from the fields of northeastern and southeastern Kentucky. The water supply at this terminal is obtained from the Licking river, which has a variation in water stage of about 50 ft. When the yard was first placed in operation the water was delivered by a 200 to 250 gal. per min. duplex power pump, direct connected to a 20-hp. alternating current electric motor, the machine being set in a house that could be moved up or down an inclined trestle to afford convenient access to the water with varying levels of the river. On account of the increased water consumption since the yard was placed in operation and to overcome other difficulties and obtain greater economy, a new steam pumping plant was constructed which embodies features of special interest.



Plan of the Boiler Room

A reinforced concrete dry well, 20 ft. in diameter and 60 ft. deep, was built near the river bank to house the steam pumps. This structure has its base below the bed of the river, so as to obtain a foundation on solid rock and extends well above high water. Flights of timber stairs supported on concrete landings, bracketed at intervals from the walls, afford access to the bottom without obstructing the center of the well. This facilitates the handling of machinery and parts in and out of the well. With the bottom of the well below the extreme low water bed of the river and its top above high water, changes in water stage in the river do not affect the operation of the pumps.

The main pumps are in duplicate, being of the compound duplex, direct acting type with cylinders 12 in. by 18 in. by 12 in. by 12 in., operating non-condensing and each having a capacity of 700 gal. of water per minute. Each pump has a separate suction line, the two lines being cross connected by means of valves and standard fittings. As upstream and downstream suction lines had to be provided on account of local conditions, each pump has four separate suction lines the major part of the year. This arrangement has eliminated a great deal of trouble on account of sand and mud encountered in the water in the river during rises in the spring and fall seasons. The suction lines are designed for a water velocity of not exceeding four feet per second and are equipped with special strainers. The strainers are made up of wrought iron pipe, drilled on one side only, with ¾-in. holes and these holes are bushed with ½-in. lead ferrules to prevent corrosion; the velocity of the water into the strainer is only 25 per cent of that in the suction pipe, being normally less than one foot per second.



Special Suction Strainers Were Installed

Water is delivered by the pumps to a 200,000-gal. elevated steel water tank through a 10-in. cast-iron pipe line about 1,200 ft. long, the total head against the pumps being about 120 ft.

The boiler house for this plant is located near the north bound main track of the railroad, the distance between the dry well and the rear of the boiler house being 142 ft. Easy access between the boiler house and the dry well is had by means of a creosoted timber trestle, with its deck at the same elevation as the top of the dry well and the floor of the boiler room, all of which are above the level reached by extreme high water.

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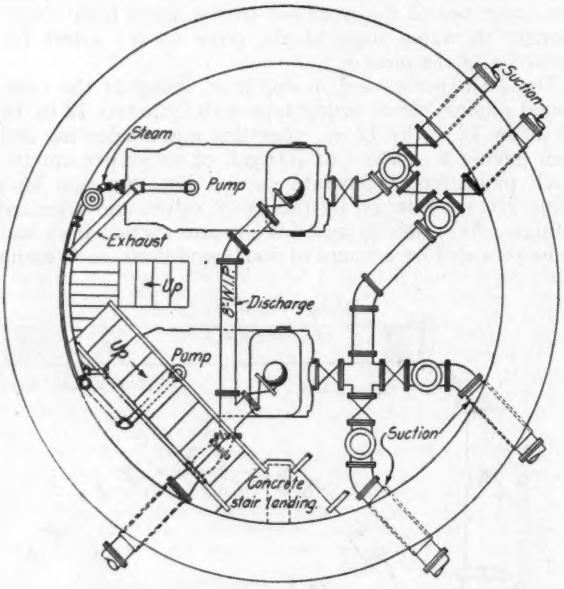
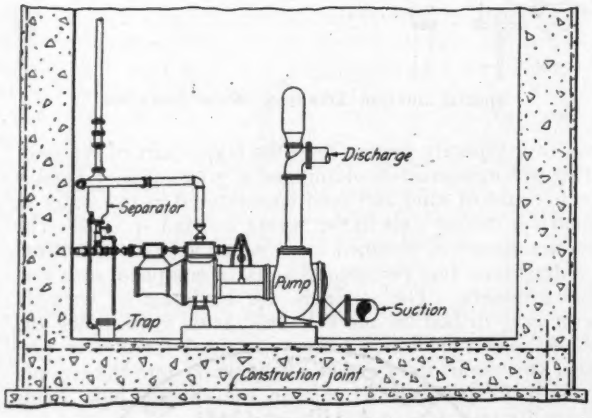
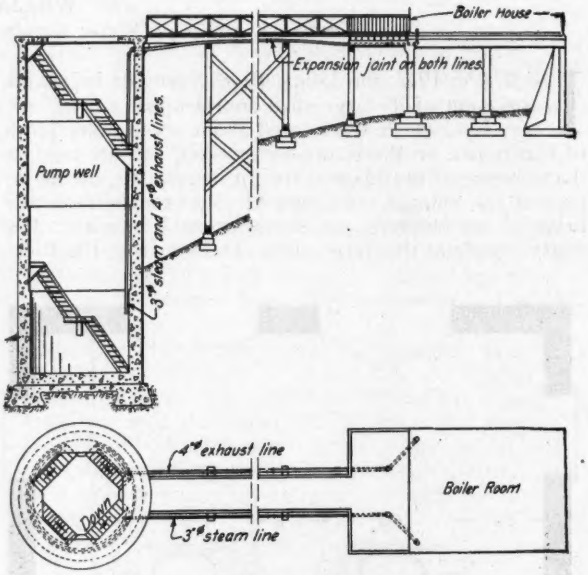
Steam is generated in two 50-hp. horizontal, return tubular type steam boilers operated at a pressure of 100 lbs. per sq. in. One of the boilers is operated at a time, together with one of the pumps in the dry well. The steam piping is carried from the boilers to the pumps across the trestle and the exhaust line is brought back across the trestle from the dry well to the boiler room; the exhaust from the pumps is returned through an open type feed water heater, located in the boiler room. Feed water is delivered to the boilers at a temperature of about 190 deg. F., being handled by one of two duplex, direct acting boiler feed pumps. The feed pumps are cross connected so as to feed either boiler from either pump. Coal for the operation of the plant is unloaded from a trestle and spur track, located directly in front of the boiler house. The pumper unloads coal from drop bottom coal cars and hauls coal from under the trestle into the boiler room in wheel barrows.





The Pump Installation in the Well

The plant is operated with three eight-hour shifts, one man on each shift. The repair and maintenance work is looked after by the division water service forces. The plant is normally operated at a capacity of 650,000 to 700,000 gal. of water per day at a cost of about three cents per 1,000 gal. The entire plant, which cost approximately $45,000, was designed by the engineering department of the Louisville & Nashville and was constructed by the division bridge and building forces. The following data were obtained from an operating test made shortly after the pumping plant was put in operation:



A General Outline of the Plant

Boiler Plant

Steam pressure at boiler, lb. per sq. in., 70; pounds of feed water per hour, 1,440; pounds of coal fired per hour, 230; feed water temperature—degrees, 192; factor of evaporation, 1.05; actual pounds of water evaporated per pound of coal, as fired, per hour, 6.26; pounds of water evaporated per pound of coal, as fired, per hour, from and at 212 deg. F., 6.57; boiler horse power developed, 43.8.

Pumping Plant

Gallons of water pumped per minute, 774; water pressure at pump, pounds per sq. inch., 50; water horse power developed, 17.9; approximate amount of dry steam used by main pump, per hour, lb., 1,150; dry steam per water horse power per hour, 64.3; duty of pump (ft. lb. per 1,000 lb. of dry steam), 30,793,200; coal fired per 1,000 gal. of water pumped, lb., 4.9; ratio of boiler horse power to water horse power, 2.45 to 1.

Building a Large Earth Fill

The Battle of the Track Gages*

How 4 Ft. 8 1-2 In. Came to Be Adopted as the Standard in the United States. A History of the Early Controversy

BY RICHARD HOADLEY TINGLEY

FOR FULLY sixty years after the building of the first railways heated controversy was waged over the question of gage. So far as this country is concerned the controversy ended in the early 80's, when most of the lines that had been laid down to odd gages were changed over to the standard—4 ft. 8½ in. Great Britain and Continental Europe also have generally, although not entirely, fallen into line, but in the rest of the world no uniformity appears to exist and all sorts of distances between rails may be seen.

Our standard gage came from England, where, even before the days of steam railroading, it had been used. In the Northumberland coal mines the wheels of the horse-drawn coal wagons dictated the gage, for rough flanges had been placed on them to run on still more crude rails—sometimes of wood. The distance, 4 ft. 8½ in., thus accidentally came about and, quite naturally, remained in use when the steam engine was substituted for the horse.

A Variety of Gages Developed

The gage battle in the United States settled in a choice between 6 ft. and 4 ft. 8½ in. The Erie was the chief exponent of the former against a large field. Besides the Erie, with its 6-ft. gage, some of the other lines which had departed from the even then almost universal custom of laying their rails to the present standard, were the Louisville & Nashville with its 5-ft. gage; the Charleston & Augusta railroad (Georgia), also 5-ft. gage; the Mohawk & Hudson, now a part of the New York Central system, 4 ft. 9 in.; the New Orleans & Northern with its 5 ft. 6 in.

There was also an "Ohio standard," so called, of 4 ft. 10 in., although in that state there were lines having the 5-ft. gage. In Missouri there had been built a considerable mileage of 5 ft. 6 in. gage. In the aggregate, however, and up to the time when all the roads not built to standard moved one of their rails in or out to meet it, no larger mileage existed of other than standard gage. In Canada, however, the 5 ft. 6 in. prevailed, which, of course, had to be changed when the United States made up its mind to do away with incongruities.

The Texas & Pacific Case

A strange case quite out of line with the times was that of the Texas & Pacific railroad, whose lines had been built to standard gage. So firmly had the 6 ft. idea taken root in the minds of some railroaders that, even as late as 1872, a violent agitation was begun to widen the gage of this standard line to 6 ft. Several reports were made at that time, each setting forth the the economic advantage of making the change or of not making it. Each produced convincing arguments to bolster up his cause—but the Texas & Pacific gage remains as first laid down.

When the Northern Pacific was under discussion during the Jay Cook regime, many engineers and railroad men thought it should adopt the 6-ft. gage and thus, by gradually connecting its eastern terminus with the western terminus of the Erie, a 6-ft. gage transcontinental line would be established which would be an object lesson to the advocates of the 4 ft. 8½ in. idea. The N. P. was constructed to standard gage, nevertheless, and the Erie, finally realizing that its 6-ft. gage had become an anachronism, fell into line.

The Erie adopted the expedient of laying a third rail over some portion of its line—thus having two gages at once, one rail being 1 ft. 3½ in. inside the other. This was done so that its old equipment might be utilized without change as long as possible. Imagine the complications of frogs and crossings under this plan. I have never heard it explained how the draw-bar heads came together in actual practice on trains of mixed gage equipment, but I distinctly remember riding out of the Erie yard in Jersey City along in the early 80's on a passenger train, with the locomotive running on one gage, the cars on the other!

So far as I am able to inform myself, the Erie was the only steam road which changed its gage to standard by piece-meal, that is, by adopting the third rail expedient, operating on both gages at the same time. Most of the railroads in this country and elsewhere made one job of their gage changing and did it in a hurry, usually over a Sunday. Most of these conversions came about in the early 80's. Some small properties, however, did not change till a long time afterward; the Cincinnati, Georgetown & Portsmouth railroad in Ohio converted its 42 miles of 3-ft. gage to the standard in five hours in 1902 by using 350 men in gangs two miles apart. In the same year the Burlington & Northwestern and the Burlington & Western roads (now parts of the C. B. & Q. system in Iowa) changed 125 miles of line from 3 ft. to standard in nine hours with 400 men in gangs about four miles apart.

On the Louisville & Nashville

The most notable achievement in gage conversion, perhaps, was that of the Louisville & Nashville, which changed 2,090 miles of main line, yard tracks and branches in 1886. The company went about this job man-fashion. For years it had been preparing for the inevitable and arrangements had been made in the shops so that wheels of cars and locomotives might be shifted to the new gage in short order. Other equipment details had been prepared for in a most careful and orderly manner. Track materials and supplies were distributed along the roadbed in advance and spikes were drawn from alternate ties, as 2,090 miles of rail had to be moved in three and one-half inches and 24 hours were allotted to the task —Sunday, May 30, 1886.

Gangs of eight men were placed at intervals of about four miles and, at 4 a. m., the work started. The gangs operated from a center starting point and worked both ways till they met the crew approaching them. About 7,000 men were employed. An inspection crew in an engine followed as fast as the conversion was made.

Different sections showed different results. Three hundred and twenty-eight miles of a branch line was converted in 14 hours; 1,762 miles of main line took 15 hours and 30 minutes; a certain 275 miles was done in 28 hours, the delay being accounted for by a severe storm; another 88 miles took 29 hours because of some slip in the distribution of materials. In the meantime 278 locomotives and 8,665 cars had been altered to match the new gage, some of which had been changed in advance.

Although more than a generation has elapsed since

*From The New York Central Lines Magazine.

American railways, by common consent, standardized their lines, and since the greater part of Europe did the same thing, 4 ft. 8½ in. is far from being the world standard today. South America still has a variety of gages. In Argentina alone there are three separate gages, 5 ft. 6 in., 4 ft. 8 in. and one meter (39½ in.), the first gage predominating.

In India there are some 14,000 miles of 5 ft. 6 in. gage and 2,000 miles of 4 ft. 8 in. On the Dutch Island of Java a portion of the lines are laid to 3 ft. 6 in. and a small part to six tenths of a meter (about 24 in.). On Sumatra about half of the lines are standard gage, the other half narrow. South Africa has standardized its lines by changing from 3 ft. 6 in. to 4 ft. 8½ in. in 1906. In Manchuria also some of the lines were converted to our standard in 1907, notably that from Hsin to Mukden, 38 miles.

The most conspicuous case of an entire continent still operating with a hodge-podge of gages is Australia, where a violent battle of gages is now in progress. On that continent 27,436 miles are built to five different gages. These are 3 ft. 6 in., 4 ft. 8½ in., 5 ft. 3 in., 2 ft. 6 in., and 2 ft.

The Qualifications of a Roadmaster*

By E. P. BRACKEN
Vice-President, Chicago, Burlington & Quincy

I HAVE been asked to define the qualifications of a roadmaster. How easy it would be to enumerate a list of virtues which would make a perfect roadmaster! But it is one thing to fill the requirements on such a line as the Pennsylvania, and another on some struggling short line whose financial condition makes it necessary to eliminate any expense which is not a matter of absolute necessity in maintaining a proper margin of safety.

A roadmaster should be a man of good personality in order to be able to establish the best possible relations between the company he represents and the public. He must be a man of infinite tact in securing satisfactory and economical results from the many nationalities and classes of labor he is able to obtain. He must be resourceful, for his work is made up of emergencies, in nearly all of which the question of opening up the line for traffic is concerned.

He must be an observing man, so that he will see every defect, many of which would escape entirely the notice of the ordinary man. In the distribution of material and the use of work trains, a large sum of money depends on the judgment which he displays in the handling of the details.

While a technical education is not an absolute necessity (as is shown by the great number of successful roadmasters without it), it is a wonderful advantage, not only to the man himself, but to the railroad. To my mind, a technical education is becoming more necessary every day, and one of the great problems before many roads is how to make the route attractive enough to induce men with a technical education to start at the bottom in the ranks of maintenance employees and work their way up so as to obtain the practical experience so necessary to a full measure of success.

There is no department on a railroad where the opportunities for waste in the use of labor and material are as great as in the maintenance of way department. Most roads have found it impracticable and too expensive to attempt to develop an exact measure of efficiency for the hundreds of different operations necessary in the maintenance of track, while in nearly all other departments there is a cost system by which comparisons can be made and a check kept on each operation. We see then how much we are obliged to depend on the discretion and judgment of the roadmaster for the efficient and economical use of materials and labor amounting to immense sums of money.

How dependent we are on him in the matter of safety, and how well he meets the test is shown by the remarkable performance of late years in the reduction of more than two-thirds in the number of accidents caused by defective track.

I do not know of any branch of railway service where promotion is so sure and will be attained in as short a time by an energetic young man with a good education who is willing to begin at the bottom, as in the maintenance of way department. The first step in authority is to a section foreman, and from that to extra gang foreman, and then to roadmaster. Under present conditions these positions are waiting for such a man as soon as he has secured sufficient experience to warrant promoting him, and we cannot say this to the same extent of any other department. A great majority of the roads today are very short of the kind of material qualified for promotion to the position of roadmaster, that is, a fairly young man who has had sufficient technical as well as practical education. The roadmaster, to an extent perhaps greater than other officers of the railroad, is thrown on his own resources, and as a rule this is a good thing for him, as it tends to develop him more quickly and to a greater extent than if conditions were otherwise.

You may ask me, "What are the rewards?" One of the greatest, to my mind, is the fact that it is an "Open Air" and a "Man's" job. Everything about it tends to develop a man physically and build him up to withstand the greater burdens of the higher positions ahead of him, and, mark this!—to the technically educated man, who has also acquired the practical side of the work, there are greater possibilities for promotion than has been the case in the past for the roadmaster with only a practical and limited education.

I wish that I could talk to the thousands of young men about to enter railroad work, and try to explain to them that one of the best courses they can pursue is to start in at the very bottom and learn the practical side of maintenance work. We have some remarkable instances of the truth of my belief in this respect on our road today. Young men, whose fathers were wealthy, and who followed this course from personal choice because they believed it was a desirable thing, are today superintendents and general superintendents and on their way to higher executive positions. There is something in the very fact that a young man is willing to start at the bottom that commends him to us all.

I have held for the last the qualification which, to my mind, has been the most necessary in bringing about the promotion of nearly every officer filling official positions on our railroads, and that is, the willingness of these men to start earlier, work harder, and stay longer than the other fellow.

*An address presented before the Maintenance of Way Club of Chicago on Dec. 13, 1922.

Marine Borers Move Up Atlantic Coast

The National Research Council Has Undertaken Extensive Investigation to Determine Most Practical Methods of Protection

BECAUSE of the large investment which the railways and other industries have made in docks and other structures along the waterfront in the harbors along the Atlantic coast, there is cause for concern in the evidence now being brought to light regarding the appearance of marine borers in these waters. Only three years ago the collapse of a number of structures in San Francisco Bay brought the ravages of these borers prominently before the owners of waterfront property of this country. As a result of the great damage done in the upper waters of San Francisco Bay, previously immune from marine borers, a committee was organized by local interests to study the problem. This committee soon found that it was necessary to enlarge the scope of the work so as to cover the entire country, and at its suggestion the National Research Council organized a committee to carry on a nation-wide study.

An investigation of the existing literature showed that while much study had been given borers for the past three hundred years, these studies had been disconnected and while much information had been developed, no conclusion had been reached. It was evident that a coordinated biological, engineering and chemical investigation offered the best chance for success.

There was found to be little information as to the distribution of the various species of borers and their living requirements. It was, therefore, necessary to find out where these various species existed, under what conditions they lived and what conditions in the water governed their distribution and activities. The damage in San Francisco was done by the teredo navalis, the pileworm of Holland. No thoroughly authenticated records could be found which indicated its previous occurrence on the American coasts. It was first identified on the East coast in Barnegat Bay, New Jersey, in 1921.

In order to secure definite information regarding the distribution of the various species and their rate of growth, a test board was designed carrying 24 blocks, one of which is to be removed from each board on the first and sixteenth days of the month and sent to Harvard University or the University of California for biological study, determination of species and rate of growth of the different species. These test boards are expected to determine the presence and species of marine borers in any locality and also the time of the year in which they work and breed. The blocks are 2 in. by 4 in. by 5 in. in size, of wide ring sappy yellow pine, surfaced on four sides. Each block is identified by a copper tag. The board with its 24 blocks is sunk from the end of a wharf or pier to an elevation about a foot above the mud line and fastened securely in place.

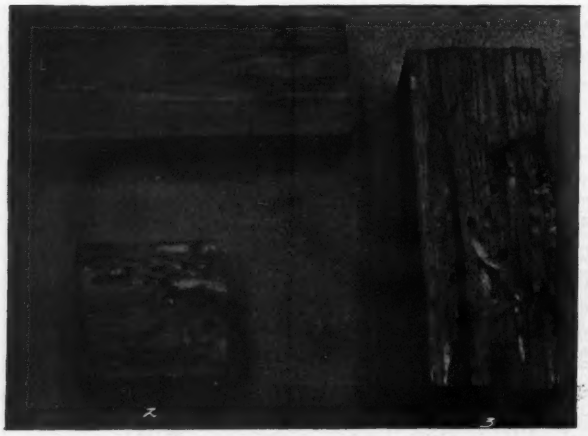
With the co-operation of the railroads, the Coast Guard, the Navy, the Army, the Bureau of Lighthouses and various state and municipal bodies and industries owning waterfront structures, 235 of these boards have been put in place between the Eastern boundary of

Map Showing Location of Test Boards, Laboratories and Experiment and Salinity Stations

Maine and Kodiak, Alaska, as well as in harbors of the American possessions in the Caribbean Sea and on the Pacific Islands. The first boards were placed in June, 1922, and the number has been increased until the total mentioned above are now in place.

As a result of the inspection of the blocks taken from these boards, teredo navalis has been found in practically all harbors from Provincetown, Mass., south to Delaware Bay, and in several other harbors in the South Atlantic and Gulf. Because this species appears to thrive in water of low salinity and with a high degree of pollution, and since it also has a very high rate of reproduction, it may be considered as probably the most destructive species of borer. The greatest activity has been found in Providence, R. I., where blocks on one of the test boards were practically destroyed in three and one-half months.

Bankia gouldi (xylotria) have been found from Delaware Bay south through the Gulf and on the Pacific Coast. This species grows at probably twice the rate of



The Condition of Some Test Blocks

(1) From Ft. Sumpter, S. C., Installed on September 6, 1922, and Removed on October 2, 1922. (2) From Ft. Sumpter, S. C., Installed on September 6, 1922, and Removed on October 23, 1922. (3) From Ft. Scriven, Ga., Installed on September 15, 1922, and Removed November 1, 1922.

teredo navalis, but it does not reproduce as rapidly—probably about 1,500,000 young per year as against 2,500,000 for teredo navalis, and so far as known it does not seem to have the resistance to low salinity and pollution that teredo navalis possesses. One of the boards carrying the test blocks in Galveston Bay was totally destroyed in two months by bankia.

A number of new or little known species of molluskan borers have also been identified; some of them apparently not being affected by creosote. The economic importance of these species will be established by further study of the test blocks.

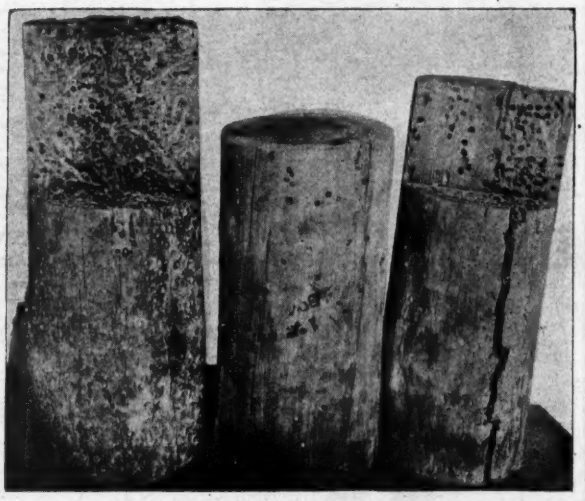
Limnoria have been identified in harbors practically all the way from Maine to Alaska. Their rate of destruction is extremely variable. It seems to be high in some locations in New England and in some Gulf and Pacific harbors.

The biological studies have shown some interesting and perhaps significant indications in the effect of the proximity of copper and iron to the borers and tests are now being carried on at Providence, R. I., Charleston, S. C., and Galveston, Texas, to determine whether a system of protection for both old and new structures cannot be developed by the use of these metals in strips or wire.

The laboratory studies of teredo navalis carried on by the University of California have given some extremely valuable information regarding this most destructive species.

In coöperation with the University of California and the Forest Products Laboratory, test blocks impregnated with various chemicals and various fractions of creosote are being tested by immersion in Gulf and Pacific harbors. Tests are also being made of several tropical woods which are reported to resist borers. Some of these timbers have European and Asiatic records showing a high resistance. As a portion of the report of the Wood Preservation committee of the American Railway Engineering Association to be submitted in March, 1923, a comprehensive study has been made of the literature on the subject of service records of various methods of protection. This report, when published, will give considerable information as to methods which have not been successful, as well as others which have given good results over considerable periods.

Reinforced concrete as a substitute for timber is becoming more and more used. Unfortunately, its record is not one of universal success. In fact, the committee has found very many more cases of failure than of success, and in most cases the causes of failure are very obscure. Studies are being carried on to endeavor to determine these causes and to produce a specification



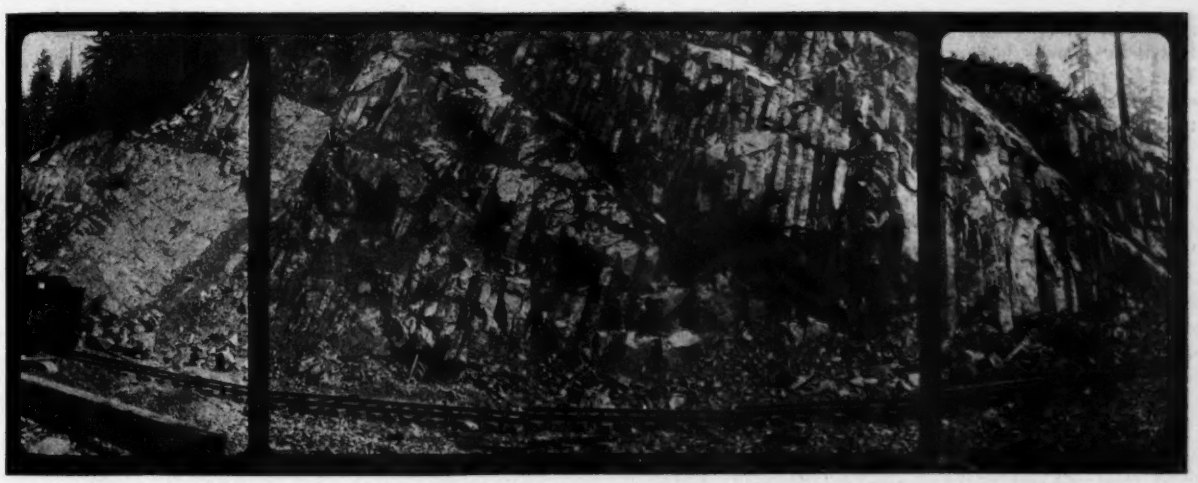
Damage Done by Bankia and Martesia

(Left) Condition of Untreated Pile Attacked by Bankia After One Year's Service in Harbor at Norfolk, Va. (Center) Untreated Piling Attacked by Martesia. (Right) Condition of Untreated Pile Attacked by Bankia After Six Months' Service in Harbor at Norfolk, Va.

which will result in a construction which can be depended on to give long life, if such a thing be possible with this material.

As the investigation goes on, the interest of the various coöperating agencies has been increasing, as several ideas giving some promise of satisfactory results have developed from the study. The next season's work should be even more productive than the last, as the preliminary work is largely completed and the lines of investigation to be followed by the biologists and chemists are becoming much clearer.

This investigation is being conducted by the Committee on Marine Piling Investigations of the National Research Council, New York City, of which William G. Atwood is director.



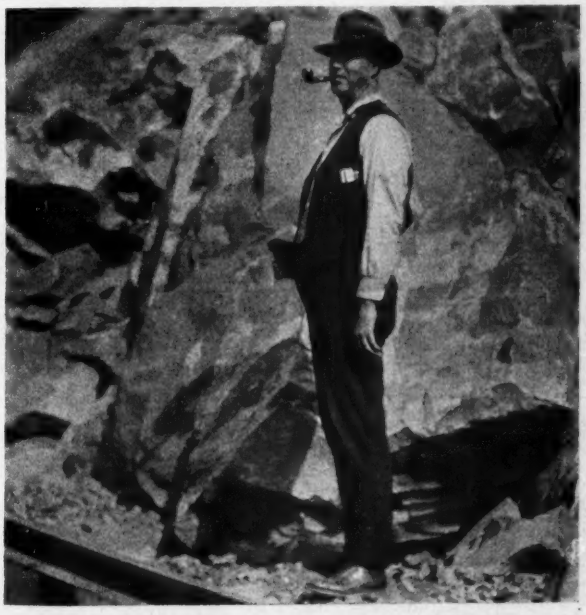
The Quarry Before the Shot, Showing the Character of the Rock

Blasting Rip Rap Economically

Coyote Holes Break Up Blocky Basalt Close to Railway Tracks Without Damaging Them and at Low Cost

By R. E. MURPHY
E. I. du Pont de Nemours & Company, Wilmington Del.

ONE of the problems constantly engaging the attention of officers in charge of construction and maintenance of way work on the railroads of the northwest is that of securing a plentiful supply of stone suitable for rip rap to protect railroad embankments along the fast flowing streams of that section. A stone to meet requirements must resist disintegration when immersed in water or when subjected to alternate periods of immersion in water and exposure to the air; it must be hard enough to resist the wear occasioned by the grinding action of rocks in contact with it and, last but not least, it must be of such density as will prevent its being moved by the current. Bodies of stone are not plentiful that meet these requirements and at the same time occur where the broken stone can be handled economically.

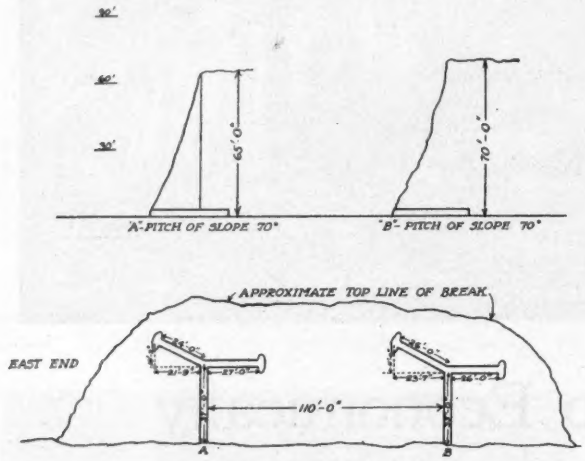


Some of the Rocks Were of Considerable Size

Some years ago, after a thorough investigation of all the available sites, the Northern Pacific established a quarry at Veazie, Washington, about 37 miles from Tacoma, on what is known as its Buckley branch. The quarry was worked by various methods until the early part of 1922, when, in an endeavor to reduce costs, it was decided to try the "coyote hole" system. Conditions at this quarry were especially favorable for working it in this way, the formation being a very hard and blocky basalt. After some consultation two tunnels three feet by three feet were driven into the face of the quarry; two crosscuts were driven from the end of each tunnel and a pocket made at the end of each crosscut to receive the explosive charge. The crosscuts on the west sides of the tunnels were driven at right angles to the tunnel line while the crosscuts on the east side were driven at an angle of 115 deg.

A total of 452 kegs of black blasting powder and 1,900 lb. of 40 per cent nitro glycerine dynamite were loaded into the four pockets. The distribution of the charge and the plan are shown in one of the drawings. The powder was loaded in the pockets without being taken out of the kegs. Each keg was laid on its side with the seam down to insure that no water reached the powder in case seepage should develop and a keg prove defective. The dynamite was taken out of the cases and loaded in the center of the black powder charge. Two cartridges of dynamite in each charge were primed with No. 6 electric blasting caps. The electric blasting cap wires were extended with No. 20 connecting wire. Each electric blasting cap in an east side crosscut was connected in series to an electric blasting cap in the adjointing west side crosscut, making two independent circuits. This was done as a safety measure in case one circuit should be broken. Clay was spread along the floor of the tunnel and crosscuts and all four wires were brought out on the west side of the tunnel. The wires were laid on the clay

spread on the bottom of the crosscuts and tunnel and protected by boards laid on top of them, a supply of old 1 in. by 6 in. lumber being used for this purpose. The crosscuts and tunnel were then tamped solidly with a mixture of damp clay and fine rock from the muck pro-



Showing How the Tunnels Were Made and the Zone Affected by the First Shot

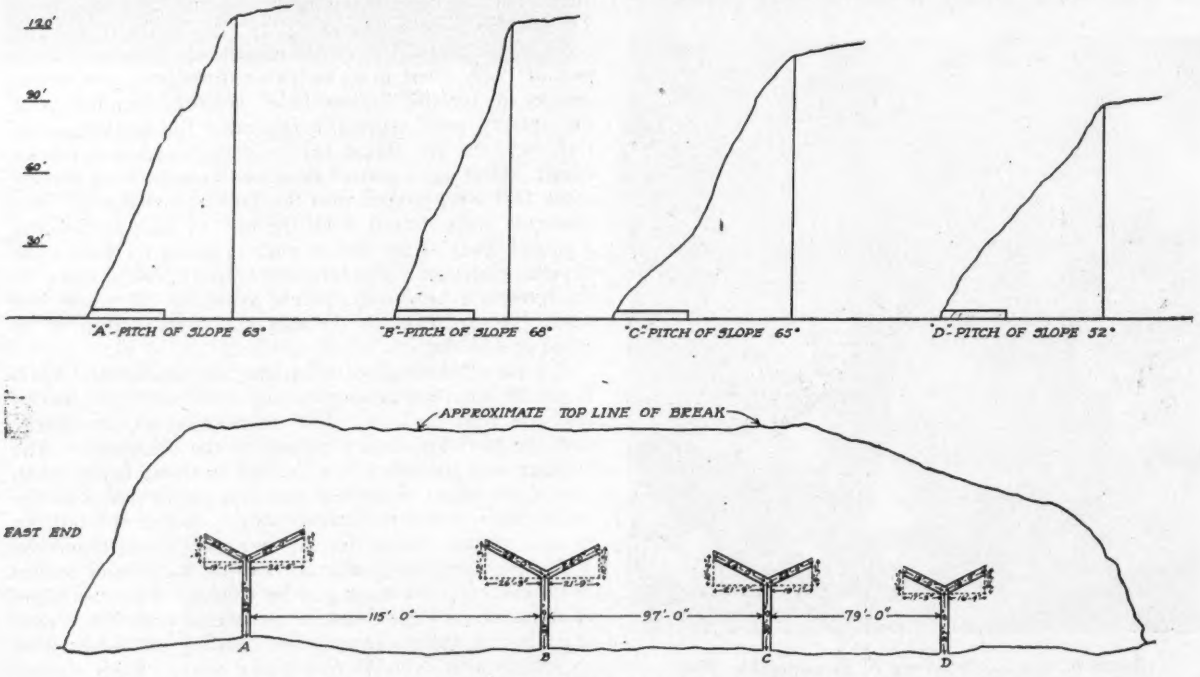
duced in driving the tunnels. When both tunnels were loaded and tamped all eight electric blasting caps were connected in one series and fired with a blasting machine.

This shot broke something more than 30,000 cu. yd. of rock or almost 2⅓ cu. yd. for each pound of explosive used. The results were so satisfactory that work was immediately commenced in preparation for another shot to consist of four tunnels with two crosscuts on the end of each tunnel. These tunnels and crosscuts were the same size as those driven for the first shot, but no pockets were cut at the ends of the crosscuts. All crosscuts were driven at an angle of 115 deg. to the line of the tunnel. A total of 620 kegs of black blasting powder, 3,050 lb. of 20 per cent stumping powder and 100 lb. of 60 per cent nitro glycerin dynamite was loaded in this shot, distributed as shown in the second drawing. All black blasting powder was loaded into the kegs and the kegs laid on their sides with the seam down, while the dynamite was taken out of the cases. The method of loading was as follows:

Nine kegs of black blasting powder were stacked up, three kegs wide and three kegs high, against the face in the end of the crosscut. Three other kegs were laid on the bottom of the crosscut, butting up against the first pile and forming the bottom row of the second pile. Then a keg was placed on top of each side keg of this first row leaving a space in the second row where the middle keg should be. Stumping powder was placed in this space and the pile filled out with black powder. This having been done a third pile was started in the same way, the space between the first and third piles then being filled with stumping powder. This program was continued until the entire charge was loaded. Both black powder and dynamite were packed in snugly. Near each end of the stumping powder charge was placed a 6¼-lb. bundle of 60 per cent nitro glycerin dynamite primed with a No. 6 electric blasting cap. This was to insure the thorough detonation of the rest of the explosive charge.

This method of loading stretched the explosive charges from the end of the crosscuts to within 10 or 15 ft. of the junctions of the crosscuts with the tunnels. The same system of wiring and tamping employed on the first shot was used on this one.

This shot was fired on August 10 and the engineers estimate that it brought down over 50,000 cu. yd. As rock or about 2⅔ cu. yd. to the lb. of explosive. As indicating further the success of the work, it may be stated that the power plant, blacksmith shop and other buildings stand directly in front of the quarry and only about 200 ft. from the face of the quarry and that about 50 ft. beyond these buildings are the Northern Pacific tracks and a high tension electric power line. In neither of these shots was any rock thrown out of the quarry yard and no damage was done to property or buildings.



Four Tunnels and Eight Crosscuts Were Made for the Second Shot

President Urges Change in Labor Board

Proposes Control By Interstate Commerce Commission—Board Issues New Seniority Rules

THE ABOLITION of the Labor Board and the assignment of its duties to the Interstate Commerce Commission was one of the pertinent suggestions embodied in President Harding's address to Congress on December 8. It was accompanied also by a recommendation that teeth be put into the clauses of the Transportation Act governing the relations of the railways and their employees. The President referred pointedly to the handicaps under which the Labor Board is now operating, under the provisions of the act governing it.

"With six partisan members on a board of nine, three partisans nominated by the employees and three by the railway managers, it is inevitable that the partisan viewpoint is maintained throughout hearings and in decisions handed down. Only the public group of three is free to function in unbiased decisions. Therefore the partisan membership may well be abolished, and decisions should be made by an impartial tribunal.

"I am well convinced that the functions of this tribunal could be much better carried on here in Washington. Even were it to be continued as a separate tribunal, there ought to be contact with the Interstate Commerce Commission, which has supreme authority in the rate making to which wage cost bears in indissoluble relationship. Theoretically, a fair and living wage must be determined quite apart from the employer's earning capacity, but in practice, in the railway service, they are inseparable. The record of advanced rates to meet increased wages, both determined by the government, is proof enough."

That something must be done to protect the public from interruptions to transportation as a consequence of labor disputes is also made clear. "Public interest," he declared, "demands that ample power shall be conferred upon the labor tribunal, whether it is the present board or a suggested substitute to require its rulings to be accepted by both parties to a disputed question."

The President also outlined in very definite terms what he considered the relation of individuals and public rights under these circumstances.

"Let there be no confusion about the purpose of the suggested conferment of power to make decisions effective. There can be no denial of constitutional rights of either railway workmen or railway managers. No man can be denied his right to labor when and how he chooses, or cease to labor when he so elects, but, since the government assumes to safeguard his interests while employed in an essential public service, the security of society itself demands his retirement from the service shall not be so timed and related as to effect the destruction of that service."

New Decision on Maintenance of Way Working Conditions

Further revision of the national agreement of the railroads with the United Brotherhood of Maintenance of Way Employees' and Railway Shop Laborers was effected by Decision 1450, issued by the Labor Board late in December, which is virtually a supplement to Decision 501 promulgated just a year ago. The earlier decision, which was reported in the *Railway Maintenance Engineer* for January, 1922, page 15, constituted a complete review of the entire national agreement with the exception of Article II, relating to seniority, and Article III, covering promotion, and one or two clauses in other articles, these clauses and articles having been remanded for further negotiation between the railroads and their employees. The present decision constitutes definite action on those portions of the agreement not included in the decision of December, 1921.

In connection with the recent hearings on this agreement, the board was requested by the employees to include in the agreement a clause definitely prohibiting the railroads from contracting work to outside concerns. The decision of the Labor Board with respect to this is that its position has already been clearly outlined in other decisions and that a further reiteration is unnecessary.

The text of the Labor Board's decision, in so far as it concerns the rules adopted, is given below. It is to be noted that all clauses marked with an asterisk have been adopted in exactly the same form as they were incorporated in the original national agreement. Those not so marked differ in some detail from the previous form. Paragraphs concerning which there was no dispute are not mentioned and stand as given in Decision 501. In general, the changes are of a minor nature. No revision was made in the provisions for payment of overtime for work done in the ninth and tenth hours or on Sundays and holidays.

ARTICLE I—SCOPE

No change from Decision No. 501.

*ARTICLE II—SENIORITY

*Sec. (a) Seniority begins at the time the employee's pay starts.

*Sec. (b) Rights accruing to employees under their seniority entitle them to consideration for positions in accordance with their relative length of service with the railroad, as herinafter provided.

*Sec. (c-1) Seniority rights of employees are confined to the department in which employed.

*Sec. (d-1) Seniority rights of laborers, as such, will be restricted to their respective gangs, except that when force is reduced laborers affected may displace laborers junior in service on their seniority district.

*Sec. (d-2) Seniority rights of laborers to promotion will be restricted to the territory under the jurisdiction of only one supervisor or other corresponding officer, except that for laborers in the mechanical department such rights will be confined to the place where employed.

*Sec. (e) Seniority rights of supervisory forces in the bridge and building department will extend over the territory under the jurisdiction of one division superintendent.

Seniority rights of supervisory forces in the track and roadway departments will extend over the territory under the jurisdiction of one roadmaster.

Seniority rights of supervisory forces over laborers in the maintenance of equipment department will extend over the territory under the jurisdiction of one master mechanic.

Sec. (f) Employees assigned to temporary service may, when released, return to the position from which taken without loss of seniority.

*Sec. (g) Seniority rosters of employees of each subdepartment by seniority districts will be separately compiled. Copies will be furnished foremen and employees' representatives and be kept at convenient places available for inspection by employees interested.

*Sec. (h) Seniority rosters will show the name and date of entry of the employees into the service of the railroad, except that names of laborers will not be included and their seniority rights will not apply until they have been in continuous service of the railroad in excess of six months.

*Sec. (i) Rosters will be revised in January of each year and will be open to correction for a period of 60 days thereafter.

*Sec. (j) Employees given leave of absence in writing by proper authority of the railroad, for six months or less, will retain their seniority. Employees failing to return before

the expiration of their leave of absence will lose their seniority rights, unless an extension has been obtained.

*Sec. (k) When employees laid off by reason of force reduction desire to retain their seniority rights, they must file with the officer of the subdepartment notifying them of the reduction their address, and renew same each 60 days. Failure to renew the address, each 60 days or to return to the service within seven days after being notified, will forfeit all seniority rights.

*Sec. (l) Employees temporarily transferred by direction of the management, from one seniority district to another, will retain their seniority rights on the district from which transferred.

*Sec. (m) In case of change in seniority districts, a relative proportion of the total employees affected will be transferred to, and their seniority rights adjusted in, the revised districts, by the management, with a properly constituted committee representing the employees.

*Sec. (n) Employees accepting positions in the exercise of their seniority rights will do so without causing extra expense to the railroad, except as provided in these rules.

*ARTICLE III—PROMOTIONS

*Sec. (a) Promotions shall be based on ability, merit and seniority. Ability and merit being sufficient, seniority shall prevail; the management to be the judge.

*Sec. (b) In transferring employees to fill vacancies or new positions, the provisions of section (a) of this article will apply.

*Sec. (c) Employees are entitled to promotion only on the district and in the subdepartment over which their seniority rights prevail.

*Sec. (d) Employees declining promotion shall not lose their seniority, except to the employee promoted and only in the next higher rank of service.

*Sec. (e) Employees accepting promotion and failing to qualify within 30 days may return to their former positions.

*Sec. (f) New positions and vacancies will be bulletined within 30 days previous to or following the dates such vacancies occur, except that temporary vacancies need not be bulletined until the expiration of 30 days from the date such vacancies occur.

*Sec. (g) Promotions to new positions or to fill vacancies will be made after bulletin notice has been posted for a period of 10 days at the headquarters of the gangs in the subdepartment of employees entitled to consideration in filling the positions, during which time employees may file their applications with the official whose name appears on the bulletin. The appointment will be made before the expiration of 30 days from the date the bulletin is posted and the name of the employee selected will then be announced. New positions or vacancies may be filled temporarily, pending permanent appointment.

*Sec. (h) The general rule of promotion and seniority will not apply to positions of track, bridge and highway crossing watchmen and flagmen at railway (noninterlocked) crossings, but, when practicable, such positions will be filled by incapacitated employees from any department, and preference in filling and retaining these positions will be determined by the degree to which incapacitated for other work, seniority in the service of the railroad and ability to perform the work.

ARTICLE IV—DISCIPLINE AND GRIEVANCES.

No change from Decision No. 501.

ARTICLE V—HOURS OF SERVICE, OVERTIME AND CALLS

Sec. (a-1, 2, 3, 5, 6 and 8) No change from Decision No. 501.

Sec. (c-1) The starting time of the work period shall be arranged by mutual understanding between the local officers and the employees' committee based on actual service requirements.

Employees' time will start and end at designated assembling points for each class of employees.

Sec. (d-1, d-2, e and f) No change from Decision No. 501.

Sec. (h) Employees whose responsibilities and/or supervisory duties require service in excess of the working hours or days assigned for the general force will be compensated on a monthly rate to cover all services rendered, except that when such employees are required to perform work which is not a part of their responsibilities or supervisory duties on Sundays or in excess of the established working hours, such work will be paid for on the basis provided in these rules in addition to the monthly rate. Section foremen required to walk or patrol track on Sundays shall be paid therefore on the basis provided in these rules in addition to the monthly rate.

Supervisory forces shall be compensated on the same overtime basis as the men supervised when the general force is required to work in excess of eight hours per day.

Sec. (i and j) No change from Decision No. 501.

*Sec. (k-1) Where special work, not within the scope of this agreement, is done outside of regular work period and extra compensation agreed upon, overtime will not apply.

Sec. (k-2, l, m, n, o, p and q) No change from Decision No. 501.

*Sec. (r) Except as provided in these rules no compensation will be allowed for work not performed.

ARTICLE VI—GENERAL

Sec. (a, b, c, d, e, f, g and h) No change from Decision No. 501.

*Sec. (i) Eliminated.

*Sec. (j) Remanded for further conference.

Sec. (m) No change from Decision No. 501.

Pennyslvania Grants Wage Increase

Following negotiations between the management of the Pennsylvania System and representatives of the Pennsylvania System Fraternity, the employees' organization on that property, an agreement was reached for an advance in wages for maintenance of way employees aggregating about $1,800,000. The increases ranged from one cent an hour for carpenters', painters' and masons' helpers to five cents an hour for assistant bridge and building foremen. The new rates were made retroactive to November 1. As seen in the tabulation of increases given below, no increase was accorded to track foremen owing to the fact that at the time that the Pennsylvania placed in effect a decrease in wages through agreement with its employees earlier in the year, which corresponded in general to the decrease in the wages of maintenance of way employees authorized by the United States Railroad Labor Board, on May 28, no decrease was made in the wages of track foremen, whereas decreases of varying amounts were made in the wages of practically all other classes of employees in the maintenance of way department. One item of interest authorizes vacations of one week to all foremen paid on a monthly basis.

The recent increases have been definitely authorized through a formal letter addressed to L. I. Kennedy, general chairman of the Pennsylvania System Fraternity dated November 28, and signed by C. S. Krick, R. E. McCarty, T. B. Hamilton and I. W. Geer, general managers, respectively, of the Eastern, Central, Northwestern and Southwestern regions. This letter follows:

In accordance with the understanding had at today's conference held with your committee representing certain employees in the maintenance of way and other departments, the following increases in rates of pay will be made effective November 1, 1922:

Bridge and building department foremen, $5 per month; bridge inspectors, $5 per month; assistant bridge and building department foremen, 5 cents per hour; track foremen, no increase; assistant track foremen, 3 cents per hour; blacksmiths, plumbers, tinsmiths and water station men and helpers (who were increased under Supplement No. 4 to General Order No. 27 and who were decreased 7 cents per hour July 16, 1922), 2 cents per hour; pile driver, ditching and hoisting engineers, 3 cents per hour; carpenters, painters, masons, 3 cents per hour, carpenters, painters, masons helpers, 1 cent per hour; assigned laborers, 2 cents per hour; drawbridge tenders, crossing watchmen, lamp lighters, pumpers, pile driver, ditching and hoisting firemen, 2 cents per hour; track and common laborers, 2 cents per hour.

The above increases to be applied as follows:

For hourly paid employes, add the hourly increase to the hourly rate.

For daily paid employes, add 8 times the hourly increase to the daily rate.

For monthly paid employes, add 204 times the hourly increase to the monthly rate.

In accordance with the understanding had, the salaries of those foremen whose present salary was fixed on the basis

of including pay for six of the seven holidays will be equated so as to include pay for the seventh holiday.

We will, effective with the calendar year, 1923, give vacations of one week to all bridge inspectors and foremen paid on a monthly basis.

Decisions of the Board

Drawbridge Operators and Steam Engineers

The New York Central operates a drawbridge over the Genesee river at Charlotte, N. Y., by steam power. Three men are employed at this bridge in eight hour shifts, their duties consisting in operating the engine to open and close the bridge, fire the boiler, and doing such incidental work as is necessary to keep the plant in working order. The employees claimed that these men are stationary engineers, while the railway contended that they are drawbridge operators. The Labor Board ruled that these men are entitled to the classification and rating of stationary engineers. (Decision No. 1354.)

Contracting of Coal and Water Handling

A case was taken before the Labor Board by the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers with respect to the contracting of the handling of coal, sand and cinders and the pumping of water and for engine watchmen on the Chicago & Alton. In this case the contract to do this work was awarded to Joseph Colianni & Brothers, all employees of the railroad having the privilege of working for the contractor at a reduced rate of pay. In its decisions the Labor Board declared that this case involved the same principles that applied in the case of the Indiana Harbor Belt. The board, therefore, decided that the contract of the Chicago & Alton constituted a violation of the Transportation Act in so far as it purported to remove the employees from the application of the act; that the employees referred to are under the jurisdiction of the Labor Board and subject to the Transportation Act and that the carrier should take up with any employee the matter of reinstatement upon the application of the employee or his representatives. (Decision No. 1254.)

Contracting Extra Gang Work

On May 30 and 31, 1921, an extra gang employed on the St. Louis-San Francisco with laborers paid 45½ cents per hour was discharged and the work being done by this gang was turned over to the Walsh Construction Company, which employed negro laborers at the rate of 20 cents per hour. The representative of the employees contended that the action of the railroad was a violation of Decision No. 2 of the Labor Board and of section 301 of the Transportation Act in that neither the employees nor their representatives were consulted prior to the action taken. The railroad contended that it was unable to continue the work at the then existing expense, but was able to resume it at greatly reduced cost. It was also argued that this action was in accord with the time-honored principle that maintenance work could be contracted and that it had been done previously. It was also contended that the action of the railroad was in accord with the provisions of the Transportation Act obligating the management to operate the property as efficiently and economically as possible. The decision of the Labor Board is that the contract of the railroad with the Walsh Construction Company is a violation of the Transportation Act in so far as it purports to remove the employees from the application of the act; that the employees of the contractors were under the jurisdiction of the Labor Board and that the carrier was directed to take up the matter of reinstatement with the employees. (Decision No. 1231.)

Contracting on the St. Louis-San Francisco

A case invovlving contracting on the St. Louis-San Francisco Railway arose in connection with the employment of pumpers and coal passers. In the early part of 1921 this road advertised for bids for the personal labor and that of any assistants required for the operation of water stations. The compensation was placed on a monthly basis, the question of hours of employment not entering into the discussion since the requirement was that the tank was to be kept supplied with water at all times.

Representatives of the employees complained of this arrangement as resulting in an arbitrary reduction of wages and a violation of seniority rights.

The decision of the Labor Board is that the contracts constituted a violation of the Transportation Act in so far as they are construed to remove the employees from the application of the act; that the employees are under the jurisdiction of the Labor Board and subject to the application of the act; and that the carrier is directed to take up with any employee the matter of reinstatement upon the application of such employee or his representatives. (Decision No. 1230.)

Right of Employees to Indefinite Leave of Absence for Brotherhood Organization Work Sustained

An employee of the Chicago, Indianapolis & Louisville had served as a bridge and building foreman from February, 1913, to June 1, 1920, with the exception of March and April, 1920, when he was granted two months' leave of absence to serve as general chairman of the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers. After this man decided to retain the office as general chairman permanently, the railway demoted him to carpenter in June, 1920, because it did not feel that an employee in a supervisory capacity should act as general chairman representing the employees. Upon being advised of his demotion this foreman made a formal request for reinstatement to the position of bridge and building foreman with the privilege of six months' leave of absence and free transportation, to which request the railway replied that it could not reconsider his demotion and that if he expected to remain in the service of the carrier as a carpenter he would have to work enough time to keep his name on the payroll, otherwise his transportation would be taken up. The employees then appealed to the Labor Board, which decided that it has been a recognized and time-honored practice with practically all carriers having working agreements with their employees to grant leaves of absence (ofttimes indefinite with full retention of seniority rights) to general chairman representing large groups of employees in order that they might perform the duties incumbent upon that position. The Labor Board, therefore, decided that the carrier was not justified in refusing further leave and free transportation to this man, and that he should be restored to the seniority roster in accordance with his standing immediately prior to June 3, 1920. (Decision No. 1342.)

Seniority of Foremen Over Laborers Denied

A track laborer on the Baltimore & Ohio was transferred to a coal tipple and later appointed foreman at the tipple. A short time later he fell back to the position of laborer and a man junior in service was appointed foreman. When forces were reduced, this foreman was set back to laborer at the tipple and the laborer was offered a position on the track. The employees raised the question of seniority between these two men, maintaining that the coal tipple was a sub-department with separate seniority and that in refusing to accept the position of foreman the man did not lose his rights as a laborer. The carrier

contended that employees promoted to foremen should be privileged to displace junior laborers, regardless of their seniority as laborers, and that the employees at the coal tipple were considered on one seniority roster with those in the track department. The Labor Board ruled that the action of a senior laborer in refusing to accept a position resulting in a junior laborer accepting the position, does not affect the seniority status of the senior laborer as a laborer. It also decided that the number of men employed at a coal tipple does not justify the consideration of this tipple as a sub-department and sustained the carrier in its action. (Decision No. 1343.)

Proof of Authority for Representation Required

On April 18, 1922, the chief executive of the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers filed a submission with the Labor Board claiming that the organization represented a majority of the maintenance of way employees and railway shop laborers on the Wabash, Chester & Western. The railway contended that there was no controversy between it and its employees; that there was no organization of the employees referred to on the railroad and that the complainant organization did not represent anyone on that property and it refused to deal with them. The Labor Board decided that the road should arrange to hold a conference with the designated representatives of the maintenance of way organization. If the brotherhood can produce evidence that the employees on this property have designated that organization to represent them, negotiations shall be conducted in an effort to agree upon rules and working conditions covering the employees involved. (Decision No.. 1357).

Responsibility of Foremen for Equipment Sustained

A section foreman on the Chicago & North Western was instructed by the roadmaster to assist the foreman on the adjoining section to change out some rails. It was necessary to transport these rails on motor cars for several miles. The visiting foreman suggested to the foreman of the section whom he was assisting that one of his gang be sent back to protect the motor cars with a flag, but the foreman on whose section the work was being done discouraged the idea. The cars were struck by a freight train and demolished. Because of this fact both foremen were dismissed, the railroad taking the position that the consolidation of gangs did not relieve the visiting foreman of responsibility for equipment in his charge. The employees protested against this disciplining of the visiting foreman. In view of the circumstances entering into this case, the Labor Board decided that the visiting foreman should be disciplined to the extent of the time lost since the date of his dismissal and that he should be restored to his former position with seniority unimpaired. (Decision No. 1355).

Selection of Employee Representation

In accordance with Decision No. 119, the Pere Marquette entered negotiations with a committee representing the United Brotherhood of Carpenters and Joiners of America which was recognized by the carrier as the duly recognized representatives of the bridge and building department. In these conferences certain working rules and agreements were agreed upon, while certain others were not agreed upon and were submitted to the Labor Board for decision. Later the road entered negotiations with the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers, in the course of which a disagreement arose regarding the scope of the rules so negotiated, the Maintenance of Way Brotherhood contending that it represented all employees in the maintenance of way department, while the carrier took the position that the bridge and building employees were represented by another committee, and should therefore be eliminated from the scope of the rules under consideration. Later Decision No. 501 was issued as a settlement of questions affecting employees in all branches of maintenance of way work and the carrier placed in effect the provisions of this decision for all employees referred to therein, including those of the bridge and building department in lieu of the rules agreed upon in the conference with the committee of the United Brotherhood of Carpenters and Joiners of America. Representatives of the carpenters and joiners organization protested against this action, contending that the road should not have applied Decision No. 501 to the employees in the bridge and building department in lieu of the rules that had been agreed upon. In its opinion the Labor Board took the position that it will not decide questions as to the jurisdiction of organizations nor as to representation of employees. It sustained the carrier in the application of Decision No. 501 to the employees of the bridge and building department but stated that the inclusion of these employees shall not preclude them from selecting representatives of their own choosing. (Decision No. 1358).

Compensation for Overtime

In a controversy with the Southern Pacific Lines in Texas and Louisiana, the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers brought three questions before the Labor Board as follows:

(a) Are employees in the track and bridge and building departments entitled to pay under Decision No. 501 for going to and returning from work?

(b) Are supervisory employees entitled to overtime for the ninth and tenth hours when the force is assigned to work 10 hours per day?

(c) Is the carrier violating the provisions of Decision No. 501 in assigning employees to work 10 hours per day?

With reference to the first question, the employees contended that the gang should have a definite assembling point at which the day would start and end, which assembling point should be the tool house, camping outfit or other designated point. The employees further contended that from the time of leaving these designated assembling points until the time that they returned they were subject to the orders of the carrier and that the time so consumed cannot be considered as their own. The carrier contended that immediately prior to Federal control, and for a number of years in advance of that time, it was the practice on the railroad involved for maintenance of way employees to go to and from work on their own time, furnishing the company 10 hours work for 10 hours pay.

In support of question two, the employees contended that supervisory forces required to work with their gangs in excess of the established eight-hour day are entitled to overtime provisions of Decision No. 501 in the same manner as the employees supervised. The carrier contended that the payment of compensation to these men at overtime rates was contrary to Section (h), Article V of Decision No. 501, which stated that such employees will be compensated on a monthly basis to cover all services rendered which are a part of their regular duties.

In support of the third question the employees maintained that in reassigning the hours of service the road violated the provisions of Decision No. 501 by arbitrarily placing an arrangement in effect without a mutual understanding with the representatives of the employees. The road, on the other hand, took the position that the infor-

mation received by it was to the effect that the majority of the employees desired to work 10 hours per day in order to avoid loss of earnings under Decision No. 1028.

In passing upon the first question, the Labor Board stated that it has been generally understood and recognized that the employees are under the supervision of the foremen and that the foremen are considered as being on duty and required to perform such functions as the inspection of track and the remedying of any defect which might be detected while proceeding to the point of work. The Board does not feel that the time so consumed can properly be considered the men's time. The Board therefore decided that the employee's time will start and end at designated assembling points "for each class of employees covered by the agreement, governing maintenance of way and bridge and building department employees."

In the consideration of the second question, the Labor Board stated that the "general force" is required to work 10 hours per day. The overtime rules are applicable to such general forces and likewise to the supervisory forces in charge for the ninth and tenth hours because of the fact that these two hours do not represent time in excess of the hours or days assigned to the general forces. It therefore ordered that supervisory forces shall be compensated on the same overtime basis as the men supervised when the general force is required to work in excess of eight hours per day.

In the consideration of the third question, the Labor Board decided that the carrier had violated the meaning and intent of section (c-1) and section (h), Article V of Decision No. 501 in establishing the ten-hour day as outlined. (Decision No. 1364).

Unit Steel Buildings Prove Practicability in Railway Service

FROM an early date, or more especially, since the introduction of so-called corrugated iron, it has not been uncommon for railroads to use steel for covering buildings. Because of its non-inflammability and such other characteristics as the facility of application and the comparatively low cost, it has been used extensively

A General View of the Labor Camp With the Steel Buildings in the Foreground

for both roofing and walls of sheds and other buildings of like character. In such cases, of course, the process of building is the usual one of applying the covering to the building framework which has been erected.

Since August, 1922, the Kansas City Southern has had occasion to test out the practicability of a more recently developed type of steel building than this in several bunk houses at Pittsburg, Kansas. These buildings are all-steel structures which embody the built-up unit principle of construction as already exemplified to some extent in frame structures, and were built to provide the necessary accommodations for the labor hired to operate the Pittsburg shop during the shopmen's strike. When it became evident not only that the strike would be prolonged, but that some difficulty was also to be encountered in securing and keeping workmen unless such arrangements were made as would render it unnecessary for the employees to leave the yards, immediate steps were taken to establish housing accommodations for them.

At the outset it was decided to build bunk houses of wood and the eating house, having been started, was so built. Considerations of delivery, fire protection, cleanliness and salvage value being favorable to the new

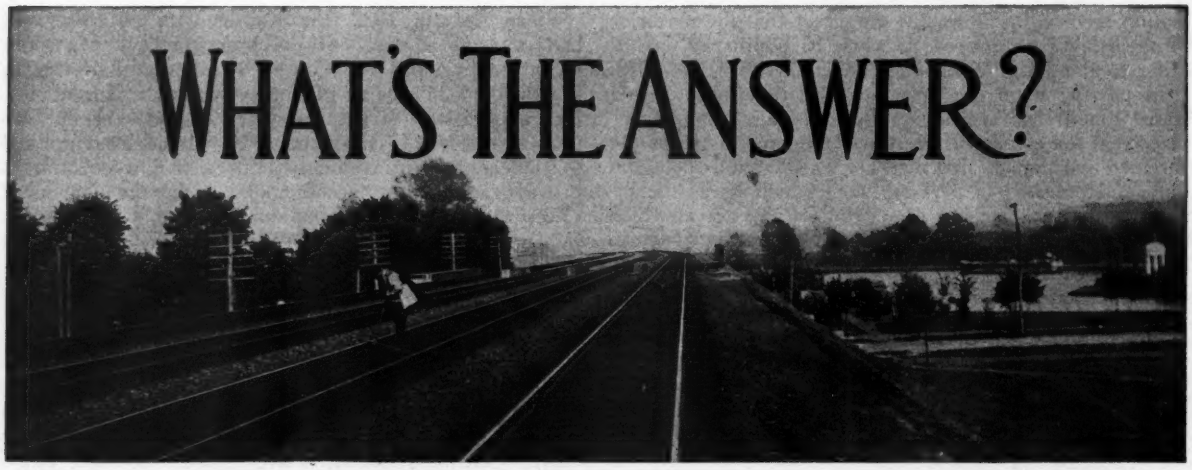
An Interior View of One of the Steel Bunk Houses

type of steel building, the original plan was changed, however, and an order was placed with the Truscon Steel Company, Youngstown, Ohio, for four of its steel buildings. Within about two weeks from the receipt of the order, the material was made ready and shipped to Pittsburg and the bunk houses placed in service, equipped with electric light and steam heat. Later three more buildings were erected making, altogether, a colony of seven steel bunk houses and one frame eating house at that point.

These buildings are each 20 ft. by 70 ft. with 8-ft. 1-in. side walls, and a gable roof supported on steel trusses. As already implied each building was erected simply by assembling factory built panels, the sheets forming the roof being held together by their interlocking edges and by clips attached to the purlins while the wall panels were secured by key wedges driven on the interior side of the buildings. Assembled in this manner, the buildings are both wind and rain proof, and with the plank floor upon which each was erected, together with an ample supply of windows including pivotal sash for ventilation, the buildings have served their purpose very well, particularly with respect to their cleanliness and their comparitive freedom from fire hazard under conditions where the possibility of fire was ever present.

While no definite plans have been made for the future use of all the buildings, present need for bunk houses having ended, it is probable that one building will be left at Pittsburg to serve as a class room for an apprentice school, while the others will perhaps be shipped to various places for use as storerooms, etc. To do this, of course, only requires the dismantling of the structures, and reassembling them at the new locations.

WHAT'S THE ANSWER?



This department is an open forum for the discussion of practical problems of engineering and maintenance of way. Readers are asked to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. *Railway Engineering and Maintenance* also solicits the co-operation of its readers in answering any of the questions listed below.

The following questions will be answered in next month's issue:

(1) When laying a water supply line in undulating country should the pipe be laid with the land or to uniform grade lines, particularly where the latter plan will require considerable excavation and possible sheathing?

(2) How many man hours are required to ballast with gravel a mile of track previously unballasted, where the roadbed has been restored to standard section in advance, the work to include the skeletonizing of the track to the bottom of the ties, the spacing of the ties and the renewal of 25 per cent of them, the track to be gaged and expansion adjusted and to be given a raise of eight inches, well tamped and dressed to standard ballast section, ditches to be cleaned and old ties burned?

(3) To what extent is it practicable to eliminate the use of cant hooks, carrying hooks and dogs from the equipment of bridge gangs using treated timber?

(4) Under what conditions is it desirable to apply sheathing for walls diagonally? What is the approximate percentage increase in cost?

(5) In surfacing a simple curve without spirals where should the superelevation be started? Is it preferable to provide half or full superelevation at the point of curve and point of tangent?

(6) Supplementing a question in the October issue, is it permissible to use anti-creepers on long pile or timber trestles? If so, what precautions, if any, should be observed?

(7) To what extent should sawdust be used for packing the ice in ice houses and in what manner, in general, should it be employed?

(8) What protection should be provided for pipe lines passing through concrete piers or foundation walls?

Sealing Springs in Foundations

What is the best way of sealing up a spring encountered when sinking a foundation or pit or in laying a culvert floor?

First Answer

My experience with cases of this kind has caused me to employ one of two methods, as conditions seem to warrant. One of these, in general terms, is to equalize the water pressure and the other is to remove the water pressure.

In the first case where conditions permit, the water from the spring may be allowed to rise in the foundation pit until it reaches a stage of equilibrium wherein no current is produced by the spring. Of course, if the head is very great, this cannot be done. Where it can be done, concrete for the footing of the culvert can then be placed in the water, care being taken to provide a vertical opening through the footing course of concrete, by means of a pipe or tile.

If the flow from the spring is in sand and comes through in numerous places, a considerable number of these vertical pipes must be provided. In some cases it is desirable to lay drain tile in the sand under the concrete footing to carry the water to these vertical pipes. If the spring is in rock, as the question indicates, one vertical pipe of sufficient size to carry the water from the spring can be placed in the rock directly over the opening. As soon as the concrete has set, the pipe or pipes may be securely plugged, the water removed from the pit and work resumed.

Where for any reason this method cannot be employed, a pipe may be laid from the spring to a suitable pit along side the culvert foundation, care being taken to make a good joint where this pipe joins the rock around the spring. In cases where the spring comes up all over the bottom of the pit, such as in sandy soil, drain tile may be laid to a pit, as described above, and this pit pumped continuously night and day until the concrete footing course has set sufficiently to resist the flow of water.

In either case, whether the pressure is equalized by allowing the water to rise to its maximum level, or whether the pressure is removed by pumping in order to plug the spring, the orifice or the orifices through which

the water from that spring is discharged must be confined to some regular shaped pipe.

F. E. KING,
Division Engineer, Chicago, Milwaukee & St. Paul, Minneapolis, Minn.

Second Answer

When a spring is encountered in the sinking of a foundation, a length of iron pipe of sufficient diameter to include all the water that is flowing, should be driven into the ground or sealed into the rock as the case may be. If the water has sufficient head to overflow the top of this pipe additional length should be screwed onto the pipe until the head is entirely overcome.

When the water has ceased to flow out of the top of the pipe, if the depth of the foundation is not sufficient to include the pipe and thus cover the spring completely, the spring may be sealed at any desired level by forcing a small sack of portland cement down the pipe to the desired elevation. As the water in this pipe is stationary this cement will remain and set solidly in place, thus effectively closing the pipe to any further flow. The pipe can then be cut off at any desired height above this cement plug.

In the case of a culvert, if the location is in a warm climate where there is no danger of the water freezing and filling the culvert with ice, a pipe should be driven into the ground to inclose the spring and then the culvert floor should be built solidly around the pipe to make a water-tight joint. The pipe can then be cut off flush with the surface of the culvert floor and the water drained through the culvert. If in a cold climate, an iron pipe should be driven down as before to include the entire flow. This should be cut off and threaded close to the bottom of the excavation for the culvert floor. A 90 deg. elbow should then be applied and sufficient pipe attached to convey the flow of the spring out to the lower end of the culvert. It is well to place the concrete for the floor of the culvert snugly around this iron pipe so there will be no chance for leakage to undermine the culvert.

EDWIN M. GRIME,
Supervisor of Bridges and Buildings, Northern Pacific, Fargo. N. D.

Removing Snow from Platforms

What is the best method of removing snow from the larger station platforms?

First Answer

The best method of removing snow from the larger station platforms will depend to a great extent on the surroundings. If there is a vacant plot of land, such as a lawn or some space that is not used, a very economical method for removing snow is to draw it away on hand sleds made to haul about two or three yards each.

Two men can pull one of these sleds with very little difficulty and it is surprising the amount of snow that eight or ten men will remove in a day by their use. Teams with wooden scrapers made especially for removing snow can be used to good advantage, providing there is a place where the snow can be piled. Trucks can also be used to good advantage and in many cases are more economical than worktrains to haul away snow from station platforms. Special shovels about 36 in. wide should be provided for station platforms, as one man can accomplish as much with one of these shovels as two men can with ordinary snow shovels.

J. W. POWERS,
Supervisor, New York Central, Rochester, N. Y.

Second Answer

Of course, the amount of snow has a considerable bearing on the method adopted to remove it. A light fall of a few inches usually needs only to be shoveled or plowed onto the track. In case of heavy snows, the surrounding physical conditions must be taken into consideration. If the platforms are in a cut the snow will have to be hauled out on cars in cases where there is not room to pile it at one side. If the platforms are situated on a fill and serve tracks on one side only, the snow usually can be disposed of simply by shoveling it down the bank. If, on the other hand, platforms serve more than one track snow may have to be hauled away. Of course, not much can be done until the plow has gone through and opened up the tracks unless the snow can be shoveled over the sides of platform, much of which will be thrown back on the platforms by the plow and require a second handling.

As to method of picking up the snow, I cannot think of anything better than a large-sized scoop shovel.

F. W. HILLMAN,
Division Engineer, Chicago & North Western, Chicago.

Protecting Bridge Floors from Brine

What is the most effective means of protecting the floors of steel bridges from brine drippings?

I know of no practical and economical way of doing this. While it is an easy matter to protect floor beams, it is almost impossible to protect stringers, due to the ties resting on them. There is no paint with which I am familiar that brine will not affect, and I do not believe that any good results can be obtained with paint unless it is applied very often. The damage being done by brine on rails, angle bars, bridges and other steel structures is getting to be such a burden that I believe it will be necessary to provide receptacles in refrigerator cars to collect the brine while on the road, which receptacles can be emptied at the end of the journey.

A. O. CUNNINGHAM,
Chief Engineer, Wabash, St. Louis.

The Proper Spacing of Wells

In sinking a system of tubular wells what steps should be taken to determine how many wells to drive and how far apart they should be sunk?

When we decide to put in wells on the Chicago, Milwaukee & St. Paul we find out something about the wells which have been driven in the vicinity. Where no wells are to be found we must depend largely upon our general experience. Sometimes, in fact, experience is the only guide. On the plains of Iowa and South Dakota, where some wells go 2,000 ft. deep, we find as a rule that wells do better when spaced from 250 to 500 ft. apart. At one place where 200 ft. wells are only 100 ft. apart, five wells furnish no more than three wells could do. There is less risk in placing shallow wells closer because they do not cost as much. They are often placed within 25 ft. of each other.

When it can be done the best thing to do is to sink one well at a time so that it can be determined just what one well can produce and what sort of material carries the water. It is important to know how much the water is lowered by the test, as this will help in determining how far distant the other well should be located. If the water comes from a gravel formation and the water level is lowered only slightly in the first well, common sense tells us that the wells can be spaced fairly close together. But if in the same well, the water is lowered a great deal it is a sign that the supply at that point is limited and the wells should be spaced farther apart or a new location sought. On the other hand, if the sand is fine it is expected that the pump will lower the

water in the well because of the friction in the sand grains. Knowing how much the head is lowered and how large the sand grains are, one can often estimate how far away the next well must be so that its circle of influence, as the area affected by the pumping is called, will not overlap the circle of influence of any other wells. In drilling shallow wells, we can tell about how large this area is by sinking a second well. If the water drops in this well when pumping from the first well, we know that an imaginary line drawn from the water level in the test well, through the level in the second well, will strike the surface of the ground at about the edge of the circle affected by the pumping. In sinking wells it is a good plan also to know the direction of the ground water, as a ditch or sewer line in the ground may sometimes intercept the flow.

C. H. KOYL,
Engineer of Water Service, Chicago, Milwaukee & St. Paul, Chicago.

Handling Steel Sheet Piling

What are the best ways to handle steel sheet piling in driving, rendering waterproof and pulling?

The several makes of sheet steel piling are interlocking and if they are properly started with the interlocking properly matched, little difficulty should be encountered in driving. Where driven in mud or soft material under the blows of an ordinary pile driver hammer a proper cushion should be used between the ends of the piling and the hammer to prevent bushing or breaking of the ends of the piles. Where driving in hard gravel it would be advantageous to use, in connection with the above method, a water jet as ordinarily used in the driving of concrete piling.

The lengths of sheet piling are, of course, determined by driving a series of test piles to rock or hard pan. Each length of piling has a hole near the top end, used either for the placing of the pile in position or for withdrawing it, the latter usually being done by means of a shackle connected through the hole in the end of the pile and then attached to the fall line on the pile driver. Where the pulling is hard, it will usually be necessary to increase the purchase of the fall line from the single line to 2, 3 or 4 lines through ordinary sheave blocks.

The waterproofing is purely a matter of keeping the interlocking in line, which in soft driving can be done with little trouble, while in hard driving material assistance is offered by the use of a water jet. Where heavy water pressure is encountered or where the piling is to be driven to an extraordinary depth it may be necessary to drive a second line of interlocking piles, the joints of the second line lapping over the joints of the first. If necessary to meet local conditions the two lines of sheathing may be driven several inches apart and then the space between filled with clay and thoroughly packed.

G. W. ANDREWS,
Assistant to Chief Engineer Maintenance of Way, Baltimore & Ohio, Baltimore, Md.

Protective Coatings for Roundhouses

What types of paints or other coatings has experience shown to be capable of withstanding engine house gases?

While a very creditable amount of study and scientific investigation has been directed to finding coatings capable of protecting exposed surfaces in and out of engine houses from the action of locomotive gases, the question is not altogether settled. Material progress has been made, however, in determining the relative merits of different ingredients in paint and much valuable data are available regarding the service records of various coatings in use. It seems well settled that such substances as linseed oil, lampblack, red oxide, graphite and the sulphates of barium are stimulators of corrosion in steel and should not be used as priming coats on metal surfaces, although it appears that carbon, lampblack and graphite pigment, singly or in the mixtures, have given excellent satisfaction as finishers, so much so, in fact, that these combined with some inert and reinforcing pigment according to special formulas form the bases for nearly all present brands of protective paints. Such substances as most of the zinc compounds, the white, blue and red leads and the carbonates and sulphates of calcium, on the other hand, appear either to be actually inhibitors of corrosion in metal or inert in their nature and, therefore, to be preferred as priming coatings.

Investigators appear to have come to the conclusion that bitumen coatings protect steel better than any other, especially on interiors, although under the influence of the hot locomotive gases sufficient trouble from alligatoring has been encountered to induce one user at least to renew its search for a better material. Where the action of the locomotive gases is especially severe, as where the surfaces are exposed to the locomotive blast, gunite appears to be giving excellent service, both as a wood and steel covering, the service records of gunite under street crossings in Chicago, for instance, having shown this material to be much superior even to cast-iron plates and similar materials.

For further information on this subject the reader is referred to Volume 15 of the proceedings of the American Railway Engineering Association, where, beginning on page 412, the results of a exhaustive investigation and study are given as to the methods of protecting iron and steel structures from corrosion. In this report is included a list of paints used by several roads, together with their service records.

Where Ties Fail First

At what point in the switch leads do ties fail first?

First Answer

The ties under the frog in a switch have a tendency to fail quicker than at any other place. This is due to the constant pounding of the wheels as they strike the frog intersection. Another reason why these ties are the first to fail lies in the tendency of the frog to get out of line due to the running of the rails and expansion in the turnout lead, necessitating spiking from time to time, all of which is destructive to the ties.

G. E. STEWART,
Assistant Engineer, Southern Pacific, Stockton, Cal.

Second Answer

The ties under the switch points fail first, as a general rule.. The cause of this is largely because the slide plates are not as wide as the ties, and heavy traffic drives the plates down into the ties, which condition requires more or less beveling to allow the switch to throw freely.

The next ties to fail in a switch will be those under the heel of the frog. The old standard switch on our road required all four joints to break even behind the frog. This put four joints on two ties, and much trouble was experienced therefrom. The new standard requires the two outside rails be run 18 in. ahead of the heel of frog, leaving three ties to serve the four joints instead of two ties, which makes the joints easier to maintain.

A. L. CAMPBELL,
Roadmaster's Clerk, Southern Pacific, Sacramento, Calif.

Third Answer

There is less chance for ties to dry out around a frog and switch points and the longer moisture remains on or near the surface of the timber the deeper it pene-

trates and this soon starts decay. Where parts of a switch vibrate under traffic the ties are worn most and forms a place to catch and hold water, which softens the wood and causes it to wear more rapidly, thus destroying the life of the tie, as the nearer strain or weight comes to the heart of timber the less resistance it has.

V. H. SHORE,
Foreman, Atchison, Topeka & Santa Fe, St. John, Kans.

Fourth Answer

The ties under the frog fail first, those under the switch, particularly the head block ties, fail next, and the intermediate ties last.

Close spacing, approximately 18 in. on centers, and careful uniform tamping is desirable for the ties under the frog, as these ties receive more severe use and due to guard rail adjustments are more often respiked. The large labor cost of renewing switch ties singly warrants the careful choosing of ties to be placed under the frog and at the switch to obtain as nearly as possible uniform life from the entire set of ties.

F. H. WATTS,
Engineer Maintenance of Way, Pennsylvania, Chicago.

Air Relief Valves on Water Lines

In cases where a long pipe line is laid with the contour of the land, how high, ordinarily, may the crest be before warranting the installation of air relief valves?

First Answer

As a general rule, air valves should be installed at every crest or summit of a pipe line, depending upon the length of line and velocity of flow. The necessity for an air valve is not dependent upon the height of the crest as much as it is by the length of the line and the position of the crest with relation to the supply, as the farther the water progresses through the pipe line the smaller the amount of air given off at the crests. The height of the crest (length of line and velocity of flow always being considered) is a factor determining the size of the air valve, as the size of the valve should be increased on the higher crests. Air valves may sometimes be omitted at low summits with long approaches in pipe lines having a high velocity of flow, the velocity of the water being depended upon to carry the air over the crest, but, as previously stated, it is a safe rule to install valves at all crests.

C. R. KNOWLES,
Superintendent of Water Service, Illinois Central, Chicago.

Second Answer

Unlike the familiar air chamber with which most piston pumps are equipped and which are often installed at intermediate points on pipe lines to catch any air tending to separate from the water and utilize it as a cushion to steady the flow, it is seldom that any need arises for the use of devices designed merely to relieve pipe lines from air pockets forming at high points or where changes in slope occur. This is true notwithstanding the fact that many pipe lines are in service throughout the country on railroads which by no means follow straight gradients. The need practically never arises in case of gravity lines kept filled, the writer recalling instances where city mains of some length rise and fall quite extensively without ever having required the installation of such valves.

In the case of lines maintained under pump pressure, the question of air valves would deserve greater consideration because of the less regular flow through the line and the tendency of the pump oftentimes to increase the quantity of air contained in the water. Even in these cases, however, it does not follow by any means that a pipe line will need such valves simply because of sags and crests which occur in it, as illustrating which, the writer has in mind an unusually long pipe line on the Rock Island which contains a good many sags but in connection with which no need has yet arisen for the installation of air relief valves. A serious objection to the use of air relief valves is the tendency of such devices to become inoperative during cold weather.

All this being so, it is impossible to say just when such valves may be required, much less to state how high crests may rise above the sags before the installation of such devices may be desirable. This will depend altogether on the amount of air getting into the line, the kind of system, size of pipe line and similar facts, usually to be determined after the line is put in service. It is the writer's opinion, however, that in any case the slope of the rise will govern to a greater extent than the total rise of the crest above the sag. In other words, the sharper the break in the slope, the greater the tendency of the air to collect and form pockets.

P. M. LA BACH,
Engineer Water Service, Chicago, Rock Island & Pacific, Chicago.

Third Answer

Automatic air valves, in general, serve two purposes. First, to expel air, and second, to admit air. There is a certain amount of air in water at all times, a portion of which is dissolved and another portion of which may be mechanically entrained. This air, in general, will collect at summits in the pipe line and must be removed therefrom, otherwise there is a tendency to air binding, which reduces the capacity of the pipe line. If the head of the pipe line in the intake or reservoir has sufficient submergence, there should be little, if any, entrained air, and if this is the case, the only source of air to be removed at the various summits is that in solution in the water.

The necessity for relief valves is determined by the proximity of the pipe line to the hydraulic grade line, rather than by the height of the crests. In general, unless the crest is within 30 or 40 ft. of the hydraulic grade line, no marked difficulties will be experienced from the collection of air.

The second purpose of installing air valves, that is, to admit air, is particularly valuable in draining pipe lines, as unless air is freely admitted into the line, the draining will be a slow process. In general, it is believed that long pipe lines should be provided with blow-offs at all low points and air reliefs at all summits. If the summit approaches within 30 or 40 ft. of the hydraulic grade line the air relief should be in the nature of an automatic air valve. If the summit is not a controlling point, then a simple air vent may be used, in which case it would be necessary to open it by hand to admit air in order to drain the pipe line.

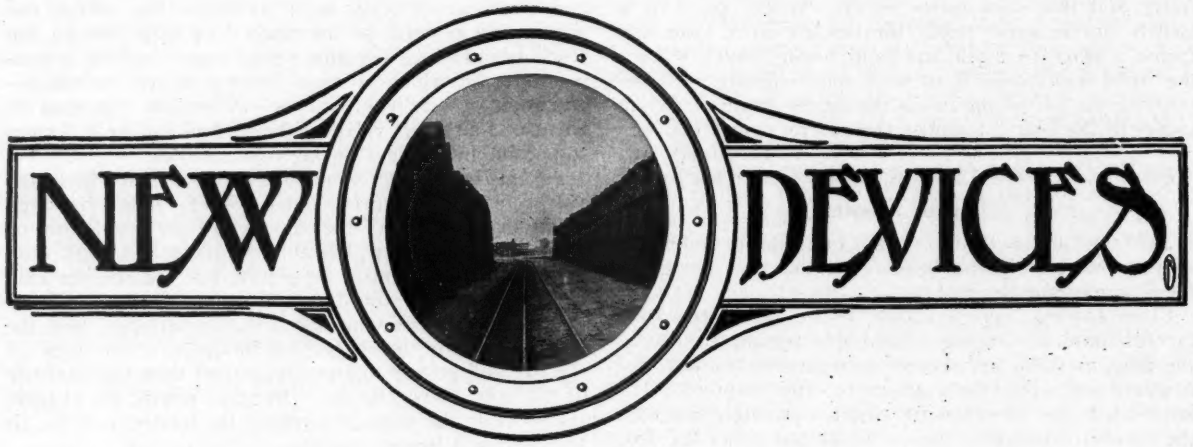
W. B. MCCALEB,
Engineer of Water Service, Pennsylvania, Philadelphia, Pa.

Banking Buildings for Winter

A Further Answer to a November Question

Where the unsightly and unsanitary aspects do not prevent its use, stable manure is probably the best material for banking buildings for cold weather. With this or earth banking, tar paper should be placed around wood work to prevent contact with banking. Cinders also make good banking material and if available can be placed after the ground starts freezing, when it is usually easier to assign men to such work. Cinders have the disadvantage, however, of being dusty. If the snow fall is heavy, a great deal of good can be accomplished by snow banking, taking advantage of the first snow to do the first banking and adding to this once or twice, as soon as sufficient snow falls.

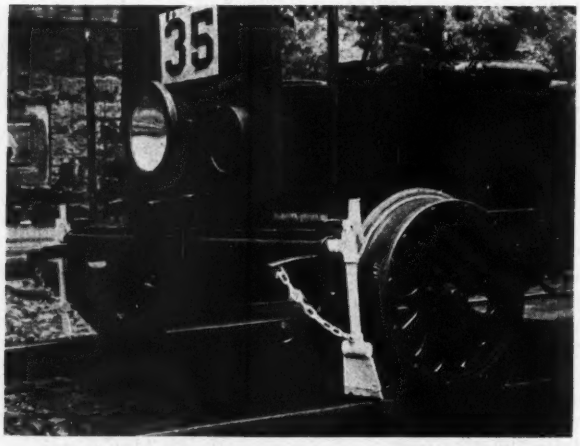
P. C. PERRY,
Division Engineer, Canadian National, Regina, Sask.



A Combination Brush and Brake For Motor Cars

IN THE last few years considerable attention has been given to the development of devices and to effecting improvements in construction and arrangement calculated to promote greater safety in the handling and operation of railway motor cars. One idea along this line that has been put to use is the combination brush and brake shown in the illustrations.

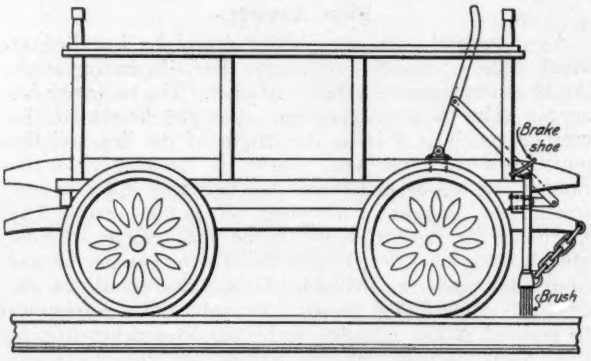
The device consists of a length of ½-in. pipe, at the ends of which are attached short lengths of 1¼-in. pipe,



A Motor Car Equipped with One of the Brushes

which are fitted at one end with a brush and at the other end with a brake shoe and so arranged that the movement of the operating lever in one direction will lower the brushes into position for removing any obstacles, and moving the lever in the other direction will apply the brake. The 1¼-in. pipe which carries the brush and brake shoes is attached to the ½-in. pipe by means of a reducing tee and the operating lever is connected to this pipe by means of a shorter piece of pipe or iron attached to the center of the ½-in. pipe, the lever itself being connected to the body of the car by means of a plate bolted to the floor. The brush consists either of a bundle of wires set in lead in the end of the 1¼-in. pipe, flattened for the purpose, or, as the photograph shows, it may consist of leather riveted to a strip of iron inserted in a pipe tee. The brake shoes are of forged steel shaped to fit the wheel and faced with a brake lining to provide the desired friction when in contact with the rim. The device is attached to the front of the car by means of U-bolts and a 3/16-in. chain is attached to each brush and to the frame of the car in order to prevent any heavy obstacle coming in contact with the brush from pushing it against the wheel.

This device is the invention of S. C. Tanner, superintendent of maintenance of way shops on the Baltimore & Ohio at Martinsburg W. Va., who has obtained a patent on it. It is said to have worked very effectively during the last two years, both in removing foreign substances from the rail and in affording a means of stopping the car quickly in cases of emergency.



A Diagram Showing How the Brake Is Attached to the Car

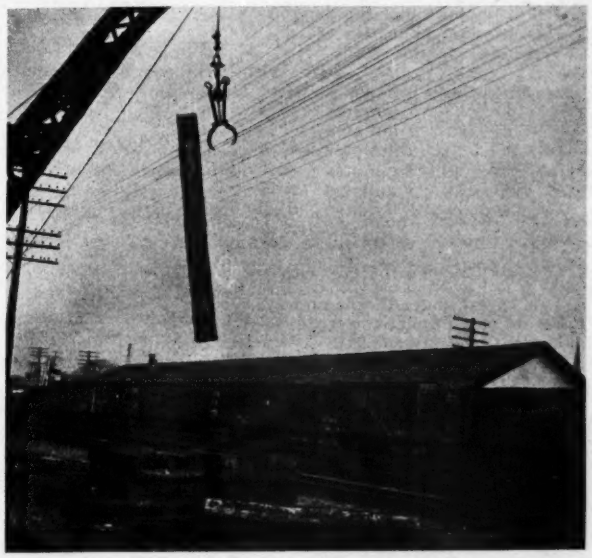
A New Development in Unloading Hooks

WITH THE OBJECT in view of expediting the unloading of ties, rails and other materials not subject to damage from dropping, there has recently been developed a type of hook which makes it possible to drop the load carried from any height desired instead of necessitating the lowering of the load to the ground to release it from the hoisting system. The illustrations show two forms of these hooks, one a tie and the other a rail hook, each of which may be handled with a steam derrick or air hoist.

The hooks consist of a pair of tongs between which is provided a movable locking block, the raising of which by means of a hoisting line unlocks the jaws and frees the load. In the case of the tie hook, one man on an open

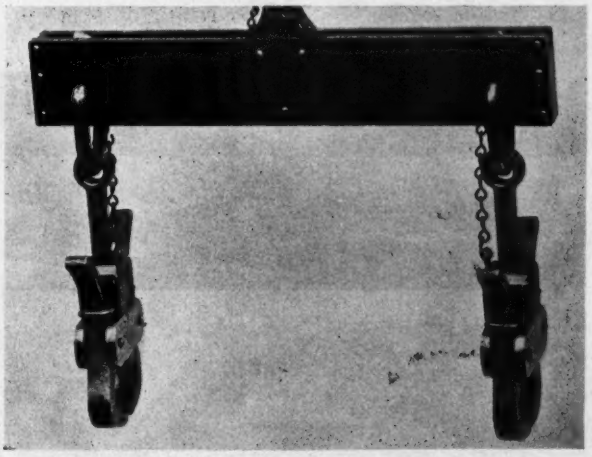
car places the tie on the hook by pressing the handles together. The ball-shaped block raises automatically when the handles of the tongs are pressed together and then drops into a locking position without manual effort. When suspended in the air, the tie which the hook carries may then be released by pulling slightly upon the hoisting line, the weight of the tie itself forcing the tongs apart. Thus designed, four ties per minute can be unloaded from an open car.

While similar in the way it releases the load, the rail



Unloading Ties With a Clough Tie Hook

hook differs from the tie hook in that the locking block does not rise automatically, but when pushed down snugly in the cross head has a positive locking effect upon the jaws, which cannot be altered until the block is pulled up. When loading scrap rail or similar material not injured by dropping, this hook enables the work to be performed by three men, one attaching the load, another steadying the rail and a third unlocking the device. It



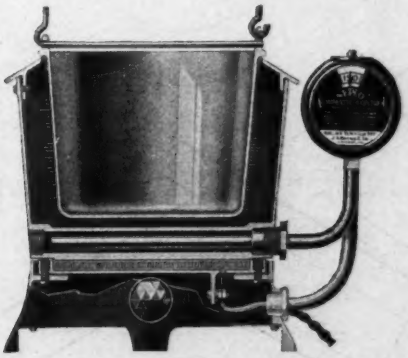
A Double Rail Hook in the Locked Position

thus dispenses with the need of a man in the car for unhooking the block, as in the case of the old style hook.

The single rail hook weighs 7½ lb. and the timber hook 22 lb., the latter being particularly useful when unloading logs from trucks or scows into water. The rail hook is made in a double hook form as well as single hook, the double hook form consisting simply of two single hooks fixed to a beam for use where two hooks are preferred in handling rail. In all cases when operating the hooks, a small pulley is attached to the end of the derrick boom, and ordinarily a one-half or three-quarter inch hemp line is used to release the load. The device is the invention of A. M. Clough, supervisor of track on the New York Central at Batavia, N. Y., and is being marketed by the Verona Tool Works, Pittsburgh, Pa., as an addition to its line of track tools.

A Constant Temperature Glue Pot

AMONG RECENT developments in equipment adapted for use in maintenance of way work is a bench glue pot capable of maintaining its contents at a constant heat. The device is called the Wallace bench glue pot and is essentially a water bath. As indicated by the sectional drawing the bath is heated by an electric element supported below the water compartment. Above this heating element is a thermostat for regulating the heat; this thermostat consisting of a tube containing a sensitive volatile substance which contracts and expands sufficiently under changes of temperature to actuate the



A Sectional View of the Wallace Bench Glue Pot

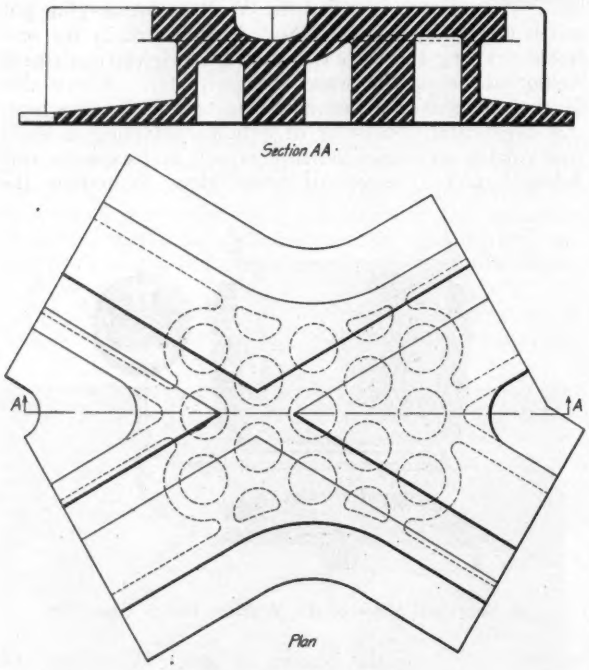
control switch of the heating element. When the heat reaches the proper temperature the control thus turns off the current and when the temperature falls a few degrees the heat is automatically turned on again. A temperature gage dial on the side of the container shows the heat maintained and this together with a jewel set in the base casting of the device acts as a visible check on the heating.

The glue container is a cast aluminum receptacle which is supported by special retainer lugs designed to prevent floating when the pot is not completely filled with the substance being heated. Adapting it still further to the purpose for which it is designed, part of the bail of the glue pot extends directly across the pot to serve as a brush wiper, thus eliminating overflow and dripping in handling the glue. The device operates from any electric lighting circuit and is adjusted to keep the temperature between 140 and 150 deg. at all times, thus eliminating losses arising from any overcooking or underheating of the glue.

Aside from its use for heating glue, the pot is adapted for heating other substances, such as wax, pitch, tar and rosin, and is said to have the advantages, aside from its automatic operation, of heating quickly and affording a secure protection against fire. The glue pot is a product of the J. D. Wallace Company, Chicago, and is manufactured in 2, 4 and 6-qt. sizes, weighing from 20 to 40 lb.

A New Development in Manganese Track Work

THE INTRODUCTION of a manganese steel crossing was a great step forward in track construction and one of the most active fields of development at the present time is to be found in the efforts being made to obtain the highest degree of perfection in manganese track work. The first manganese crossings put in service years ago had about 1⅜ in. of metal under the treads and about 1 in. of metal under the flangeways. The resistance to wear was phenomenal, but it was soon discovered that cracks were developing in the flangeways at the intersections. Many cases are on record where the entire corner broke away from the main body of the casting. Such conditions were a menace to traffic and the manganese manufacturers found that considerable improvement could be obtained by adding metal directly under the intersections so that the total section was about 2⅛ in. under the flangeways and about 4⅛ in. under the treads. This, however, brought about a new trouble—the pounding down of the points and the flowing of the metal into the flangeways.



The Tubular Construction

After careful study it was discovered that 75 per cent of the pounding down of the points took place during the first 60 days the castings were in service, and also that the longer they were in service the harder and stiffer the steel became. This led to the idea of casting the crossings with excess metal on the points and then pounding it down cold with a specially constructed hammer to produce the hardness and stiffness that the points were obtaining in service through the action of traffic for a period of 60 days. This is known as the "AMSCO" method, adopted by the American Manganese Steel Company, Chicago Heights, Ill., and has been applied to about 100 castings made for a number of frog and switch manufacturers. None of the points on these castings has pounded down more than ⅛ in. nor has the metal flowed.

With this problem solved, attention was directed to overcoming unsoundness in the metal due to excessive thickness at the intersections. This was accomblished by developing a so-called tubular construction formed by introducing a series of cored holes in the underside of the crossing, whereby a solid thickness of 1⅜ in. of metal is provided under the tread and 1 in. under the flangeway, while the remaining depth below the flangeway and tread consists of a series of ribs approximately ¾-in. thick. Crossings of this type have been subjected to tests in comparison with crossings of the standard intersection with favorable results for the former as indicated in the statement of results herewith. In addition, a number of crossings of this new form of construction, manufactured by the Louisville Frog & Switch Company, Louisville, Ky., are now in service on the railroads.

Bending Test of Two Manganese Steel Crossing Intersections*

STANDARD INTERSECTION "A"

2¼ in. metal under the flangeways.
4¼ in. metal under the tread.
Weight of casting, 464 lb.

Tons Pressure.	Time.	With Pressure On. Deflection.	With Pressure Off. Set.
100	5 minutes	¼ in.	None
150	5 minutes	¼ in.	1/16 in.
200	5 minutes	5/16 in.	1/16 in.
250	5 minutes	½ in.	⅜ in.
300	5 minutes		⅞ in.
350	1 minute	Badly broken in the intersection.	

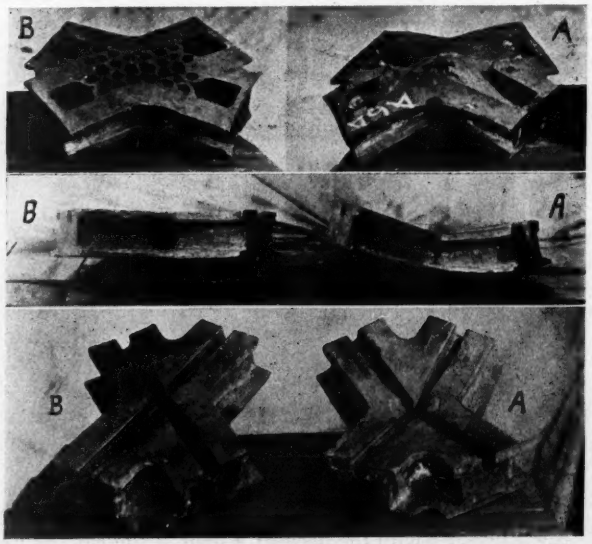
SPECIAL INTERSECTION "B"

Perforated with cored holes.

1 in. metal under the flangeways.
1⅜ in. metal under the tread.
Weight of casting, 528 lb.

Tons Pressure.	Time.	With Pressure On. Deflection.	With Pressure Off. Set.
100	5 minutes	⅛ in.	None
150	5 minutes	⅛ in.	1/32 in.
200	5 minutes	⅛ in.	1/32 in.
250	5 minutes	⅛ in.	1/32 in.
300	5 minutes	1/16 in.	3/32 in.
350	1 minute	¼ in.	⅛ in.

Test discontinued at capacity pressure of the press.
One rib underneath the intersection showed a slight crack.



The Tubular and Standard Specimens After the Bending Test. B, Tubular; A, Standard

*The castings were poured in the same heat and given the same treatment and tested over a span of 24 in.

American Railway Engineering Association

The date of the convention has been set forward from the third week in March to the second week. The convention will therefore be held in Chicago on March 13 to 15 inclusive. The National Railway Appliances Association will present its exhibit of materials and devices used in the construction and maintenance of railway tracks and structures, on the same dates.

With reports from 17 of the committees in the hands of the secretary, some of which have already been sent to the printer for insertion in two bulletins, it is evident that the handicaps under which railway men have worked during the past year have not interfered materially with the completion of the reports and that most, if not all, of these reports will be in the hands of the members well in advance of the convention.

Wood Preservers' Association

The association has arranged for a special train to New Orleans which will leave Chicago at 10:30 a. m., Sunday, January 21, via the Illinois Central. Special cars will also be attached to a train leaving St. Louis on the same road at 1 p. m., and to a train leaving Louisville at 12:10 p. m., making connections with the special train at Carbondale, Ill., and Fulton, Ky. The Pennsylvania will also carry a special car leaving New York and Philadelphia on Saturday morning for Louisville, where it will join the car originating at that point. The train will arrive at New Orleans on Monday noon.

The program for the convention was published in the December issue. In addition to the details presented there arrangements have been made for the inspection of the New Orleans dock system by boat on Wednesday afternoon. It is also planned to visit the sawmills of the Edward Hines Lumber Co. at Lumberton, La., on Friday, stopping en route to go through the creosoting plant of the Southern Creosoting Co. at Slidell and to make an inspection of the N. O. & N. E. bridge across Lake Pontchartrain, a landmark in timber preservation.

Tie Producers' Association

The National Association of Railroad Tie Producers will hold its annual convention in the St. Charles Hotel, New Orleans, on January 25 and 26, immediately following that of the Wood Preservers' Association.

Where Track Must Be Well Maintained

The Material Market

THE YEAR 1922 closed without any indication of the softening of prices which normally occurs in some commodities at this season of the year. In fact, those who are studying economic conditions are now perplexed as to the prospect before us. It is clear that prices will not be lowered, but what will the upward tendency be? Will there be a steady market with little or no advance from the present level, or will we have a runaway market such as precipitated the liquidation of 1920? Most conditions point to a conservative, steady maintenance of the market during the winter season. The total orders for structural steel for the month of November indicated the effect of a seasonal decline but there was a noticeable restoration of business in December with considerable new business in prospect for January. Recent business in rail and track appliances has been light, but the prices of these materials continue steady.

	Prices in Cents Per Pound			
	November 20		December 29	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.75	$2.85 to $3.00	$2.75	$2.85 to $3.00
Track bolts	$3.85 to 4.50	3.85 to 4.00	$2.75 to 4.50	3.85 to 4.00
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.35	2.35	2.35 to 2.50	2.35
Tie plates, iron		2.50		2.50
Plain wire	2.45	2.79	2.45	2.79
Wire nails	2.70	3.04	2.70	3.04
Barbed wire, gal.	3.35	3.69	3.35	3.69
C. I. pipe, 6 in. or larger, per ton		51.20		51.20
Plates	1.90 to 2.00	2.10 to 2.20	2.00	2.10 to 2 30
Shapes	1.90 to 2.00	2.10 to 2.20	2.00	2.10 to 2 20
Bars, soft steel	2.00	2.00 to 2.10	2.00	2.00 to 2.10
Open hearth rail per gross ton f. o. b. mill				43.00

Prices in scrap items are steady or slightly advancing with the sellers of scrap holding out of the market in anticipation of further advances.

	Prices Per Gross Ton at Chicago	
	November	December
Relaying rails	$32.00 to $35.00	$32.00 to $35.00
Rerolling rails	18.00 to 18.50	18.50 to 19.00
Rails less than 3 ft. long	19.00 to 19.50	20 00 to 20.50
Frogs and switches cut apart	17.00 to 17.50	17.75 to 18.00
	Per Net Ton	
No. 1 railroad wrought	15.50 to 16.00	15.50 to 16.00
Steel angle bars	17.00 to 17.50	17.00 to 17.50

Thus far, the lumber business has been able to avoid the seasonal decline entirely. Slow deliveries during the fall months have held back the business so that in the case of the Southern pine mills, the volume of unfilled orders is larger at present than at any time since February, 1920. The total at the end of the year was 3,000,000 ft. b.m. as compared with half that amount the first of January, 1922.

Southern Mill Prices	November	December
Flooring, 1x4, B. and B., flat	$50.10	$51.10
Boards, 1x8, 14 and 16, No. 1	38.40	38.30
Dimension, 2x10, 16, No. 1, common	29.95	30.35
Dimension, 2x4, 16, No. 1	30.75	33.55
Timbers, 4x4 to 8x8, No. 1	24.45	27.50
Timbers, 3x12 to 12x12, No. 1		30.30
Douglas Fir Mill Prices		
Flooring, 1x4, No. 2, clear, flat	38 00	39.00
Boards, 1x6, 6 to 20, No. 1, common	14.00	15.00
Dimension, 2x4, 16, No. 1, common	20.50	20.50
Dimension, 2x10, 16, No. 1, common	21.50	21.50
Timbers, 6x6 to 8x8, No. 1, common	18.00	18.00
Timbers, 10x10 to 12x12, rough	20.00	20.00

The recent readjustment of the prices of Portland cement has effected reductions ranging from 10 to 15 cents. Current prices in carload lots, f. o. b. eight middle western cities are as follows. These prices do not include package.

Chicago	$2.05	Duluth	$2.04
Cincinnati	2.39	Milwaukee	2.44
Davenport	2.28	Minneapolis	2.29
Detroit	2.33	Pittsburgh	2.14

General News

The United States Supreme Court will hear arguments on January 8 in the injunction suit of the Pennsylvania Railroad against the Railroad Labor Board.

The Missouri, Kansas & Texas was sold on December 13 for $28,000,700 to Randolph & Blumenthal, representatives of the reorganization managers, J. & W. Seligman & Co., and Hallgarten & Co., New York.

The receivers of the Chicago, Peoria & St. Louis have filed an application with the Interstate Commerce Commission for authority to abandon this company's entire line from Pekin to East St. Louis, Ill., with branches from Havana to Jacksonville and from Lock Haven to Grafton, a total of 237 miles.

E. N. Brown, chairman of the board of the St. Louis-San Francisco, announced on December 13 that his company has purchased the entire capital stock of $7,500,000 of the International-Great Northern and will operate its 1,159 miles of line, if approval is given by the Interstate Commerce Commission.

The Economics of Water Service for Railway Locomotives will be the topic for consideration by the Western Society of Engineers, Chicago, on Monday, January 22. C. H. Koyl, engineer of water service of the Chicago, Milwaukee & St. Paul, and W. C. Smith, mechanical superintendent of the Missouri Pacific, will discuss this subject in its various phases.

A total of 9,249, or 70 per cent, of the 12,907 foreign-born employees on the Eastern region of the Pennsylvania have either become naturalized American citizens or have obtained their first papers. Forty-eight nationalities are represented: Italians, 5,707; English, 1,610; Irish, 1,444; German, 696; Austrian, 586; Polish, 528; Russian, 511; Hungarian, 338; Norwegian, 177; Spanish, 172; Swedish, 148; Scotch, 139; and Czecho Slovak, 102.

The Illinois Central has for several months been engaged in the reduction of grade and the construction of additional tracks near Monee, Ill., in connection with which a drag line has been employed successfully for excavation work. The drag line is equipped with a five-yard bucket operated from a 75-ft. boom and has been excavating heavy clay to a depth of about 20 ft. over a section 60 ft. wide at sub-grade. This machine has handled about 3,200 yd. per day of two shifts.

Within recent months the railways have made the following new records: (1) They moved more freight in November than in any previous November in history. (2) The week ended November 25 terminated a period of ten consecutive weeks in every one of which the railways moved more carloads of freight than in any seven consecutive weeks previous. (3) The total carloads handled in the 16 weeks ended December 9 were larger than ever moved in the corresponding 16 weeks of any other year. (4) In 34 out of the 35 weeks ended on December 2 the railways moved more carloads of miscellaneous freight than they ever did in the same weeks of any previous year. (5) The railways loaded 45,886 cars with bituminous coal on Monday, December 11, which is the largest number of cars ever loaded with bituminous coal on any other day. (6) During six consecutive weeks the total "car shortage" reported exceeded the largest car shortage ever reported in any single week of any previous year.

The Pennsylvania Railroad Y. M. C. A. Building and Loan Association of Jersey City, N. J., which was organized on July 1, 1919, now has over 1,000 shareholders with over 5,000 shares subscribed. The association has at the present time over $150,000 in assets and its monthly receipts total over $6,000. It has issued 38 loans, 34 of which were made to railroad employees to assist them in purchasing homes.

In one of the most spectacular fires of Chicago's downtown district in several years, the Dearborn street station, built in 1884, and used by the Atchison, Topeka & Santa Fe, the Chicago & Western Indiana, the Chicago & Eastern Illinois, the Chicago, Indianapolis & Louisville, the Wabash, the Chesapeake & Ohio, the Grand Trunk and the Erie, suffered damage estimated at $300,000 on December 21. The fire was attributed to crossed electric wires. The building is being repaired.

Eight railroad employees on trial for conspiracy to interfere with interstate commerce were found guilty by a jury in the United States District Court at Los Angeles, Cal., on December 20. The charge was that defendants had plotted to tie up traffic on the Atchison, Topeka & Santa Fe at Needles, Cal., last August by causing a walkout of trainmen. More than a thousand passengers were marooned several days in intensely hot weather, and much freight and mail were delayed.

Employees of the Pennsylvania Railroad have bought, through the Mutual Beneficial Association, 27,000 shares of the stock of the railroad company, of which about 1,500 shares were purchased during one week. J. K. Linn, treasurer of the Mutual Beneficial Association, Philadelphia, through whom the purchases are made, reports that he recently received nearly 1,000 names of employees desiring to buy stock, from one limited territory, most of them ordering a single share each. The stock is bought in the open market and the Mutual Beneficial Association keeps the shares for a time so as to allow the buyers to pay in installments.

Correction

In the report of the Roadmasters' convention, which appeared in the December issue of the Railway Maintenance Engineer, the statement was made at the conclusion of the discussion of the report on the Non-Spacing of Joint Ties and the Non-Slotting of Joints (page 436) that the association voted in favor of the elimination of the spacing of joint ties and the slotting of the joints. This is in error with respect to the spacing of joint ties as the association voted down the motion placing it on record as favoring the elimination of the spacing of joint ties.

The Results of Track Inspection

The Pennsylvania, Eastern Region, has awarded track premiums amounting to $4,600 to supervisors and their assistants on main line divisions. The largest, amounting to $1,200, $800 for the supervisor and $400 for his assistant, went to Division No. 33 of the Philadelphia division, extending from Lancaster, Pa., to Steelton. Supervisor H. H. Kauffman would have been the recipient of this prize but as he died during the latter part of the inspection period one-half of his portion was paid to Mrs. Kauffman and the other one-half was distributed among the track foremen and laborers on his sub-division. J. B. Otto, Jr., was the assistant supervisor on this territory.

The improvement prize of $1,000 ($700 to the supervisor and $300 to his assistant) went to J. D. Lovell, supervisor, and R. H. Crew, assistant supervisor, on Division No. 44

of the Middle division, extending from Anderson, Pa., to Huntington. Additional premiums of $800 each ($600 for the supervisor and $200 for his assistant) were awarded to J. D. McIntyre, supervisor, and G. H. Schlotterer, assistant supervisor, on Division No. 43 of the Middle division, extending from Durward, Pa., to Anderson; to M. deK. Smith, supervisor, and L. M. Leedom, assistant supervisor, on Division No. 4 of the New York division, extending from Princeton, N. J., to Liddonfield, Pa.; and to E. L. Koch, supervisor, and E. L. Smith, assistant supervisor, on Division No. 81 of the Maryland division.

These premiums were awarded on the basis of monthly inspection trips by a committee of operating officers.

The Pennsylvania, Northwestern region, in its annual track inspection, awarded the first prize of $250 to E. B. Kirchner, supervisor on the Ft. Wayne division; the second prize of $200 to C. McCarthy, supervisor on the Logansport division and the third prize of $150 to J. H. Britton, also a supervisor on the Logansport division. Additional prizes of $50 were awarded foremen having the best sections.

The Pennsylvania, Southwestern region, annual inspection, resulted in the award of first prize to M. J. Boyle, supervisor of sub-division No. 3 of the St. Louis division. Second prize went to Henry Rice, supervisor of sub-division No. 2 of the Columbus division, with headquarters at Urbana, Ohio. Third prize was awarded to Henry Hoge, supervisor of sub-division No. 2 of the Louisville division, with headquarters at Columbus, Ind. The prizes were $200, $150 and $100, respectively. An additional prize of $50 was awarded to the foreman having the best section on each supervisor's sub-division.

The Long Island has awarded $200 as first prize for the best line and surface on the Long Island to F. J. Nehrhoff, supervisor, in charge of track between Rockville Center, Sag Harbor and Montauk, with headquarters at Patchogue, New York. W. M. Steers, supervisor of Division No. 5, with headquarters at Hicksville, New York, and R. L. Hering, supervisor of Division No. 2, with headquarters at Jamaica, New York, were tied for the second prize of $100, and were each awarded this amount. K. L. Hammann, supervisor of Division No. 3, with headquarters at Jamaica, received the special improvement prize. Awards of $100 were made to five foremen and of $50 to a similar number of men for excellence in work on their respective sections.

The New York Central gave the highest rating among the main line sub-divisions to sub-division No. 7 of the Mohawk division, of which F. L. Vault is supervisor at Utica, N. Y., with a grade of 83.3, while sub-division No. 7 of the Syracuse division, of which W. N. Skelton is supervisor at Syracuse, N. Y., ranked second with a grade of 82.9. The Syracuse division received the highest division rating with a grade of 82.6. The foreman having the best track on each main line sub-division also received a premium of $3 per month, while the man having the best secton on each division received an additional premium of $2 per month. The foreman having the best track on each branch line sub-division received a premium of $2 per month, while the foreman having the best yard section on each sub-division received a premium of $3 per month.

The Pere Marquette gave the Toledo-Ludington division the highest rating with a grade of 88.63, an improvement of 0.65 over its rating last year when it also led other divisions. The territory of L. P. Garnett, supervisor on the Petoskey division, with headquarters at Traverse City, Mich., received the highest rating of any supervisor's district with a grade of 90.66. The territory of William Meier, supervisor on the Detroit division, with headquarters at Benton Harbor, Mich., received the next highest rating of 89.34. The greatest improvement over 1921 was also made by Mr. Garnett's subdivision but as he had been awarded the prize of $100 for the best track, the improvement prize of the same amount was awarded to Nels Jorgensen, roadmaster on the Muskegon division, with headquarters at Muskegon, Mich., whose sub-division received a rating of 88.158, an improvement of 1.798 over the rating given the subdivision last year.

Personal Mention

General

P. J. Neff, division engineer on the St. Louis-San Francisco, with headquarters at Ft. Worth, Tex., has been appointed assistant to the president of the International-Great Northern, with headquarters at Houston, Tex.

Engineering

J. E. Starbuck, assistant engineer on the Southwestern region of the Pennsylvania System, with headquarters at St. Louis, Mo., has retired.

J. G. Hartley, assistant division engineer on the Central region of the Pennsylvania System, with headquarters at Pittsburgh, Pa., has been promoted to division engineer with headquarters at New Castle, Pa.

C. F. Duvall has been appointed assistant engineer on the Rio Grande division of the Texas & Pacific, with headquarters at Big Spring, Tex., succeeding **H. L. Bunn,** who has been transferred to Marshall, Tex., in place of **J. G. Roney,** resigned.

J. P. Davis, roadmaster of the Central Indiana, with headquarters at Anderson, Ind., has been promoted to engineer maintenance of way, with the same headquarters. **J. H. Ramsey** has been appointed assistant engineer maintenance of way, with the same headquarters. The office of roadmaster has been abolished.

G. W. Koontz, roadmaster on the Delaware & Hudson, with headquarters at Carbondale, Pa., has been appointed division engineer on the St. Louis-San Francisco, with headquarters at Ft. Worth, Tex., succeeding **P. J. Neff,** who has resigned to become assistant to the president of the International-Great Northern.

E. L. Crugar, district engineer of the Southern lines of the Illinois Central, with headquarters at New Orleans, La., has been appointed to the newly created position of engineer of construction of the system, with headquarters at Chicago. **J. W. Kern,** roadmaster of the St. Louis division, with headquarters at Carbondale, Ill., has been promoted to district engineer of the Southern lines, succeeding Mr. Crugar.

R. C. Bardwell, engineer of water service of the Missouri Pacific, with headquarters at St. Louis, Mo., has been appointed superintendent of water supply of the Chesapeake & Ohio, with headquarters at Huntington, W. Va. Mr. Bardwell was born on January 1, 1888, at Tipton, Iowa, and graduated from the University of Illinois in 1909. He entered railway service on June 1, 1910, as a chemist in charge of water softening plants on the Missouri Pacific and on October 16, 1916, was promoted to assistant engineer of water supply, which position he held until June 1, 1917, when he became chief chemist. On October 1, 1920, he was promoted to engineer of water service, the position he held at the time of his recent appointment.

L. H. Bond, district engineer of the Northern lines of the Illinois Central, with headquarters at Chicago, has been promoted to assistant engineer maintenance of way of the Illinois Central and the Yazoo & Mississippi Valley, with headquarters at Chicago, succeeding **W. G. Arn,** whose promotion to assistant chief engineer, Chicago Terminal Improvements, was mentioned in the December issue of the *Railway Maintenance Engineer.* **M. M. Backus,** district engineer of the western lines, with headquarters at Waterloo, Iowa, has been transferred to Chicago to succeed Mr. Bond. **J. E. Fanning,** roadmaster of the Iowa division, with headquarters at Fort Dodge, Iowa, has been promoted to district engineer, succeeding Mr. Backus, as noted above.

E. O. Wood, supervisor of track on the Pennsylvania System, with headquarters at Johnstown, Pa., has been promoted to assistant division engineer on the Central region, with headquarters at Pittsburgh, Pa., succeeding **J. G. Hartley,** promoted, as noted elsewhere. Mr. Wood was born at Bordentown, N. J., on July 31, 1878, and graduated from

Rutgers College in 1898. From September 1, 1898, to January 16, 1900, he was a draftsman for Manning, Maxwell & Moore at Philadelphia, Pa. He entered railway service on January 18, 1900, as a rodman on the West Jersey & Seashore, which position he held until March 19, 1905, when he became a transitman on the Pennsylvania, with headquarters at Altoona, Pa. From July 1, 1905, to November 10, 1909, he served as an assistant supervisor successively at Blairsville, Pa., Lancaster and Harrisburg, and on the latter date was promoted to supervisor at Sunbury, Pa. On June 16, 1909, he was transferred to Trenton, N. J., and on February 5, 1917, was transferred to Millersburg, Pa., where he remained until September 1, 1918, when he was transferred to Johnstown, Pa., where he was located at the time of his recent promotion.

F. G. Jonah, chief engineer of the St. Louis-San Francisco, with headquarters at St. Louis, Mo., has been appointed assistant to the president and chief engineer in charge of engineering, maintenance and construction, with the same headquarters. Mr. Jonah was born on October 6, 1864, in Albert county, New Brunswick, and entered railway service in May, 1882, as a student in the chief engineer's office of the Intercolonial Railway. In 1887, he was appointed assistant engineer in charge of construction of government lines in Nova Scotia and from 1889 to April, 1890, was assistant engineer of the Intercolonial. In April, 1890, he became assistant engineer of the St. Louis Merchants' Bridge Terminal Railway leaving in April, 1894 to become resident engineer of the St. Louis, Peoria & Northern. From December, 1899, to May, 1901, he served as engineer maintenance of way of the Chicago & Alton, and was chief engineer of the Blackwell, Enid & Southwestern from May, 1901, to March, 1903, when he was appointed assistant engineer of the New Orleans Terminal Company. He held this position until June, 1903 when he was appointed chief engineer of the St. Louis, Brownsville & Mexico and the following year was appointed locating engineer of the St. Louis & San Francisco, returning to the New Orleans Terminal Company as terminal engineer in May, 1905. From January 1, 1910, to March 1, 1913, he was chief engineer of construction of the St. Louis & San Francisco at St. Louis, Mo., and on the latter date was promoted to chief engineer. During the world war Mr. Jonah was successively major, 12th Engineers and chief engineer of the Department of Light Railways in France, and upon his return from military service in 1920 resumed his former position of chief engineer of the St. Louis-San Francisco, the position he held at the time of his recent appointment.

Track

A. J. Barbee, assistant roadmaster in the Milwaukee terminals of the Chicago, Milwaukee & St. Paul, with headquarters at Milwaukee, Wis., has been promoted to roadmaster in the Chicago terminals, with headquarters at Cragin, Ill., in place of **G. A. Larson,** who has been transferred to Milwaukee.

C. W. Lentz, chief building inspector of the Illinois Central, with headquarters at Chicago, has been appointed roadmaster of the Indiana division, to succeed **G. M. O'Rourke,** transferred to the St. Louis division to succeed J. W. Kern, promoted, as noted elsewhere in these columns.

N. R. Hill, supervisor on the Illinois Central, with headquarters at Council Bluffs, Iowa, has been promoted to roadmaster of the Iowa division, with headquarters at Fort Dodge, Iowa, to succeed **J. E. Fanning,** promoted to roadmaster, as noted elsewhere in these columns.

F. F. Mallon has been appointed roadmaster of the Pendleton district of the Second division of the Oregon-Washington Railroad & Navigation Company, with headquarters at Pendleton, Ore., and **F. A. Boscow** has been appointed roadmaster of The Dalles district of the First division, with headquarters at The Dalles, Ore.

J. A. M. Brown, roadmaster on the Canadian National, with headquarters at Drumheller, Alta., has been transferred to the Battle River, Alliance and Scona subdivisions of the Edmonton division of the Alberta district, with headquarters at Camrose, Alta., succeeding J. Eagleson, transferred to Hanna, Alta., **A. J. Walsh,** roadmaster, with headquarters at Regina, Sask., has resigned.

J. F. Swenson, assistant supervisor of track on the Eastern region of the Pennsylvania System, Maryland division, has been promoted to supervisor of track with headquarters at Erie, Pa., succeeding **Leo St. Clair Pie** transferred to Kittanning, Pa., in place of **W. W. Portser** who has been transferred to Conemaugh, Pa., to succeed **E. O. Wood** whose promotion to assistant division engineer is noted elsewhere in this issue. Mr. Swenson was born on July 25, 1888, at Irwin, Pa., and received his education at the Pennsylvania State College. He entered railway service as a rodman on the Buffalo division of the Pennsylvania and was subsequently promoted to assistant supervisor on the Delaware division, later being transferred consecutively to the Baltimore, New York and Maryland divisions where he was serving at the time of his recent promotion.

Louis Hansel, section foreman on the Sioux City and Dakota division of the Chicago, Milwaukee & St. Paul, with headquarters at Elk Point, S. D., has been promoted to roadmaster, with headquarters at Beloit, Wis. Mr. Hansel was born on December 24, 1881, at Chicago, and entered railway service as a track laborer with the Chicago, Milwaukee & St. Paul in 1897 and was promoted to section foreman on the Wisconsin Valley division in 1905, later serving as assistant foreman on extra gangs. In 1912, he was again promoted to extra gang foreman and in 1916 became a section foreman on the Kansas City Division, which position he held until 1919 when he was appointed an extra gang foreman on the Sioux City and Dakota division. In the fall of 1919, he was appointed section forman on the same division, with headquarters at Elk Point, S. D., the position he held at the time of his recent promotion.

E. H. Brock, assistant roadmaster on the Canadian National, with headquarters at Tichfield, Sask., has been promoted to roadmaster, with headquarters at Melville, Sask., succeeding **H. M. Wilson,** assigned to other duties. He was born at Pikeville, Tenn., on June 4, 1876, entered railway service as a section laborer on the Nashville, Chattanooga & St. Louis in November, 1898, and served as a section laborer on this road and the Texas & Pacific until September, 1902. From September, 1902, he was successively section and extra gang foreman on the Missouri Pacific, the St. Louis Southwestern and the Great Northern until April 8, 1911, when he became roadmaster on the latter road. On October 23, 1916, he was appointed roadmaster on the Canadian Pacific, which position he held until November 30, 1921. At the time of his recent promotion he was assistant roadmaster on the Canadian National, with headquarters at Tichfield, Sask.

M. J. McDonough, track supervisor on the Delaware & Hudson with headquarters at Carbondale, Pa., has been promoted to roadmaster with the same headquarters succeeding **Geo. W. Koontz** who has resigned to become division engineer on the St. Louis-San Francisco, as noted elsewhere in these columns. **C. A. Koch,** extra gang foreman with headquarters at Carbondale, has been promoted to track supervisor succeeding Mr. McDonough.

Al L. Harlow, roadmaster on the Denver & Rio Grande Western, has been appointed roadmaster of the LaGrande district of the Second division of the Oregon-Washington Railroad & Navigation Company, with headquarters at LaGrande, Ore. Mr. Harlow was born on November 21, 1877, at Breckenridge, Mo., and entered railway service on April 4, 1899, as a laborer on the Chicago, Burlington & Quincy. He was promoted to foreman in October, 1900, and served as extra foreman from June, 1908 to 1914, when he became a yard foreman on the Union Pacific. He became a roadmaster on the Denver & Rio Grande in July, 1919, and resigned in May, 1920, to become an assistant roadmaster on the Union Pacific, being promoted to roadmaster in January, 1921. He returned to the Denver & Rio Grande Western in May, 1922, as a roadmaster, which position he held at the time of his recent promotion.

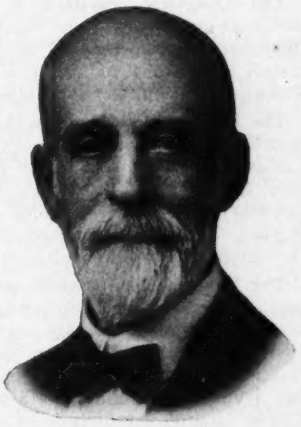
Bridges and Building

J. Boler, bridge foreman on the Western division of the Toledo & Ohio Central, has been promoted to supervisor of bridges and buildings on the Eastern division, with headquarters at Thurston, Ohio, succeeding **J. W. O'Neil,** who

has been transferred to the Kanawha & Michigan, with headquarters at Hobson, Ohio, in place of **Paul Eberst**, retired on pension.

James Haynes has been appointed supervisor of bridges and buildings on the Memphis division of the Southern, with headquarters at Sheffield, Ala., succeeding **T. E. Smith**, deceased.

James Rivett, supervisor of buildings on the Chicago, Burlington & Quincy, Lines West, with headquarters at Lincoln, Neb., retired December 31 after 42 years and 6 months of continuous service with this road. Mr. Rivett was born at Podington, Bedfordshire, England, in August, 1852, where, after completing his education, he served as an apprentice learning the building trade until 1872, when he emigrated to Nebraska. After working for two years as a carpenter and for five years thereafter as a partner in building contracting, he entered railway service as superintendent of building construction in the employ of the then chief engineer, T. E. Calvert, of the Burlington & Missouri River, now a part of the Chicago, Burlington & Quincy. Mr. Rivett continued in this capacity on the Burlington & Missouri River and the Chicago, Burlington & Quincy continuously up to the time of his retirement, during which the Burlington-Denver line was extended west from Indianola, Neb., and the Billings line west from Aurora, Neb., the system expanding from 596 miles of line west of the Missouri river to 4,896 miles.



James Rivett

Obituary

Ernest C. George, general foreman of bridges, buildings and water service of the Beaumont division of the Atchison, Topeka & Santa Fe, died recently in the Santa Fe hospital at Temple, Tex. Mr. George was born at Nolton, Quebec, Canada, and had been in the service of the Santa Fe since 1882.

Hearings on the Interstate Commerce Commission's consolidation plan will be resumed before Commissioner Hall and Examiner Healy at Washington on January 17, when it is planned to consider the proposed Union Pacific-Chicago & North Western, the Santa Fe-Colorado & Southern-Denver & Rio Grande Western and the Southern Pacific-Rock Island consolidations.

The Chicago, Burlington & Quincy, the Great Northern and the Northern Pacific are planning a $1,000,000 campaign to advertise the institutions, the economic resources, the development, the history and the future of the northwest. Officers are now traveling through this territory collecting information which will be used in the campaign. The campaign will be handled through the Burlington offices. A motion picture scenario laid in Colorado, Yellowstone Park and Glacier Park has been completed and will be displayed in cities throughout the United States.

The hearing before the Interstate Commerce Commission on the controversy between the Southern Pacific and the Union Pacific over the control of the Central Pacific was practically concluded on December 13 after testimony amounting to nearly 4,000 pages had been presented, accompanied by over 100 exhibits. The controversy arose out of the order of the United States Supreme Court directing the Southern Pacific to relinquish control of the Central Pacific and the subsequent application to the Interstate Commerce Commission by the Southern Pacific to continue this control.

Construction News

The Atchison, Topeka & Santa Fe has awarded a contract to Sharp & Fellowes of Los Angeles, Cal., for the construction of a second track on the Albuquerque division for 8.6 miles between Dalies, N. M., and Rio Puerco and for 32.6 miles between Perea, N. M., and Defiance, and will begin construction upon the completion of the second track work now under way at Griffith, Ariz. This company has also awarded a contract to Sharp & Fellowes for the construction of second track on the Arizona division for 40 miles between Griffith, Ariz., and Topock, and for 65.1 miles between Bagdad, Cal., and Daggett. Between Bagdad and Lavic, the double track will follow a new line. This company has awarded a contract to R. E. McKee, El Paso, Tex., for the construction of a brick and steel passenger station at Phoenix, Ariz., to be built in conjunction with the Southern Pacific at a cost of approximately $300,000.

The Baltimore & Ohio has awarded a contract to the Graver Corporation, Chicago, for the construction of a 50,000 gallon capacity water softener at Mansfield, Ohio.

This company has placed a contract with the Seaboard Construction Company, of Philadelphia, Pa., covering the erection of new spans required to provide additional waterway at its bridge crossing Grand Calumet river, Gary, Ind. The additional opening supplements a 14-ft. arch built in 1908.

The Belt Railway of Chicago has awarded a contract to Rowley Brothers Company, Chicago, for the construction at Chicago of a brick freight house, 40 ft. by 220 ft., with a wood platform 300 ft. long, the total cost of which will be approximately $75,000.

The Boston & Albany has authorized a new station at Springfield, Mass., estimated to cost about $4,000,000. Bids will be called for as soon as detailed plans can be completed. It is estimated that approximately three years will be required to complete the work, which includes the station proper, an office building, a baggage, mail and express building and a new interlocking system. Nine tracks with 20 ft. platforms and canopies will be provided at the station.

The Boyne City, Gaylord & Alpena has applied to the Interstate Commerce Commission for a certificate authorizing construction of a branch line from Alpena to Rockport, Mich., 13 miles.

The Canadian National will construct a connection approximately 29½ miles long, between the Canadian Northern Ontario near Longlac, Ont., 480.7 miles northwest of North Bay, and the Canadian National near Nakina, Ontario, 52.25 miles west of Cochrane, the effect of which will be to reduce the rail distance from Winnipeg to Montreal to 1,357 miles as compared with 1,411 via the Canadian Pacific, and 1,459 via the Canadian Northern and the distance from Winnipeg to Toronto to 1,207 miles, as compared with 1,257 miles.

The Canadian Pacific has awarded a contract to the Sidney E. Junkins Company of Winnipeg and Vancouver for the construction of an ocean pier, 330 ft. by 850 ft., at Vancouver, B. C., at an approximate cost of $2,000,000. The work is to be completed by September 30, 1923.

The Central of Georgia will close bids on January 22 for the construction of a 600-ton capacity concrete coaling station at Macon, Ga.

The Chesapeake & Ohio is reported to have approved the construction of a 90 ft. by 242 ft. two story fruit terminal station at Cincinnati, O., to cost approximately $240,000.

The Chicago & Western Indiana has awarded a contract to the E. W. Sproul Company, Chicago, for the reconstruction of the Dearborn street station in Chicago damaged by fire on December 21.

The Chicago, Burlington & Quincy will build second main track for six miles between Sorento, Ill., and Ayres, at a cost of approximately $200,000, as well as a new double track line

two miles long, to cost approximately $185,000, at Weston, Mo., to replace track which has been damaged by high water. This company has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the laying of 18,000 ft. of 16 in. pipe for its water treating plant at Galesburg, Ill., and is again considering plans for the construction of a union station at Clinton, Iowa, to serve the Chicago, Burlington & Quincy, the Chicago, Rock Island & Pacific and the Chicago Milwaukee & St. Paul, and which is expected to cost approximately $40,000.

The Chicago, Indianapolis & Louisville will construct a one-story frame shop 45 ft. by 200 ft., at Lafayette, Ind., to cost approximately $8,000, to replace one recently destroyed by fire, and has awarded a contract to the Ogle Construction Company, Chicago, for the rebuilding of a coaling station of 300 tons' capacity at South Hammond, Ind., to replace one recently destroyed by fire.

The Chicago, Rock Island & Pacific will construct a 24 ft. by 115 ft. passenger station at Carlisle, Ark., to cost approximately $15,000, and has inquired for bids for the construction of a brick and stone station at Clay Center, Kan., to cost approximately $15,000. This company, reported in the December issue as closing bids November 14 for a frame ice house at Eldon, Ia., to cost approximately $12,000, has awarded the contract to Joseph E. Nelson & Sons, Chicago.

The Chicago Union Station is calling for bids for the construction of 12 concrete piers to carry the Metropolitan Elevated across its property.

The Cleveland, Cincinnati, Chicago & St. Louis has awarded a contract to the Ogle Construction Company, Chicago, Ill., for the construction of a 400-ton, three track, concrete coaling station at Hillsboro, Ill.

The Edward Hines Yellow Pine Trustees have been authorized by the Interstate Commerce Commission to place in operation in interstate commerce a railroad from Lumberton to Kiln, Miss., a distance of approximately 52 miles, a road built primarily to facilitate the applicants' logging operations, but subsequently made the object of a demand from the inhabitants of the territory to have it placed in operation as a common carrier.

The Great Northern contemplates the construction early in 1923 of a new engine house and repair shop at St. Cloud, Minn., and has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 500-ton fireproof, three track, automatic electric roller skip type locomotive coaling plant at Havre, Mont.

The Gulf, Colorado & Santa Fe is constructing with company forces a 32 ft. by 80 ft. frame freight station, with platform at McGregor, Tex., and has awarded a contract to Doullutt & Williams, of Galveston, Tex., for the construction of two 400 ft. steel and concrete train sheds at Galveston, to cost approximately $30,000.

The Illinois Central has completed plans for the construction of approximately 175 miles of single track line from Edgewood, Ill., to Fulton, Ky., at a cost of approximately $13,000,000. The line will include a tunnel one mile long and when completed will be about 20 miles shorter than the present route via Centralia and Cairo. The sections between Edgewood, Ill., and Aiken, and between Fulton, Ky., and Metropolis, will be undertaken first.

This company has inquired for bids for the construction of 38 miles of second track from Central City, Ky., to Dawson Springs, to include yard and terminal facilities at Central City and to cost approximately $3,000,000.

This company will construct a spur track three miles long from the main line at Elkville, Ill., to the mine of the Black Servant Coal Company, at an estimated cost of $50,000, the work to be commented at once by company forces, and will construct 9,000 ft. of track from Providence, Ky., to the St. Bernard Company's mine.

This company will construct an extension and rearrange its passenger station at New Orleans, La., at an approximate cost of $20,000, and is considering plans for the construction of a new freight house and passenger station at Covington, Ky., to replace one recently destroyed by fire at that point.

This company closed bids December 28 for the construction of a gravel washing facility of 2,000 yd. daily capacity at Freeport, Ill., and has awarded a contract to the Ellington Miller Construction Company for brick wash room at Memphis, Tenn.

The Kansas City Terminal Company, jointly with the city of Kansas City, plans the construction of a 1,500-foot viaduct near Chestnut and Guinotte avenues, Kansas City, Mo., crossing the tracks of the Chicago & Alton, the Missouri Pacific, the Kansas City Terminal and part of Guinotte avenue.

The Longview, Portland & Northern received bids at its headquarters at Kelso, Wash., until January 1, 1923, for the construction of roadbed, bridges and culverts for approximately 8½ miles of railroad in Cowlitz county, Wash. Twenty-three miles of track are expected to be laid in 1923.

The Louisiana & Arkansas, through its agents, Harrington, Howard & Ash, consulting engineers of Kansas City, Mo., has awarded a contract to the Herman & McCain Construction Company, Little Rock, Ark., for the building of a one-story brick and reinforced concrete locomotive shop at Minden, La., to cost approximately $150,000. The shops of the company were previously at Stamps, Ark.

The Louisville & Nashville, which was reported in the December issue as contemplating the construction of a steel bridge at Rigolets, La., has awarded a contract to the Missouri Valley Bridge & Iron Company, Leavenworth, Kan., for the construction of the piers, and with company forces has begun construction on 15 miles of second track on the Cumberland Valley division between Baileys, Ky., and Wallsend.

The Missouri, Kansas & Texas will close bids on January 12 for the construction of a six-stall roundhouse addition and a new power house at Franklin Junction, Mo.

The Missouri Pacific will construct a 21 ft. by 20 ft. addition to its passenger station at Council Grove, Kan., and will make extensive alterations to the present structure.

This company has awarded a contract to the Railroad Water and Coal Handling Company, Chicago, for the underground work connected with the installation of sprinkler systems for fire protection in its shops at St. Louis, Mo., Nevada, Crane and Poplar Bluff. This company has awarded a contract to the Herman & McCain Construction Company, Little Rock, Ark., for the construction of a brick passenger station at Harrisburg, Ark., to be 24 ft. by 71 ft., and has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a one-story brick boiler house, 47 ft. by 50 ft. at Coffeyville, Kan.

The Montana Railway, which is being incorporated at Miles City, Mont., will begin early in 1923 the construction of a line from Miles City to Sheridan, Wyo. C. J. Haskell, 347 Madison avenue, New York City, is president of the company and C. S. Lake, at the same address, is chief engineer.

Morgan's Louisiana & Texas Railroad has been ordered by the Louisiana Public Service Commission to construct a viaduct over and across its tracks, facilities and properties in New Orleans, La.

The New York Central, jointly with the city of Cleveland, contemplates the construction of a new bridge at Cleveland, Ohio, to cost approximately $100,000.

The Oregon, California & Eastern has awarded a contract to the Eschbach-Bruce-Nettleton Company, Seattle, Wash., for the construction of 14 miles of line from Hildebrand, Ore., to the Sprague river, to cost approximately $100,000. Further construction plans of this company were reported in the October issue, page 367.

The Pacific Southwestern has been granted permission by the Railroad Commission of California to construct a standard gage line from Lompoc, Cal., to White Hall, a distance of approximately four miles.

The Pennsylvania has awarded a contract to H. E. Culbertson Company, Cleveland, Ohio, for the construction and placing of concrete piling for track elevation work through Cleveland, and is revising the plans for the elevation of its tracks at Garfield boulevard near Leavitt street, Chi-

cago, which were made several years ago, and will begin construction in the spring.

The St. Louis-San Francisco has awarded a contract to C. E. Hamilton, St. Louis, Mo., for the construction of a five-stall frame roundhouse, 70 ft. by 92 ft., to be built at Muskogee, Okla., to replace one recently destroyed by fire, and contemplates the construction of a new freight warehouse at Fayetteville, Ark., and is considering remodeling the present passenger station. This company is contemplating the construction of a new line from Sipsey, Ala., to Arkadelphia.

The Southern Pacific plans the construction of a bridge across the Colorado river at Yuma, Ariz., in a new location, to cost approximately $2,000,000.

The Union Pacific is about to call for bids for the construction of the first unit of new shop and yard facilities at Los Angeles, Cal., to be located between Jaboneria road and Telegraph road, south of Ninth street on the main line in the eastern part of Los Angeles. The principal structures of the first unit, which will cost approximately $1,750,000, are a 20 stall brick roundhouse, a locomotive erecting and boiler shop, coach car and blacksmith shop and a car repair shop with transfer table, storehouse, office buildings and power house, Approximately 18 miles of track will be laid in receiving, classification and departure yards, and in the engine terminal and car repair tracks.

The Wabash contemplates the construction of a locomotive repair and machine shop at Decatur, Ill.

The Wisconsin Southern, which was organized recently, has completed surveys for a line from Madison, Wis., to Calumetville, and plans to begin grading and track laying in March, 1923. The road will eventually extend from Madison to Manitowoc and other lake Michigan points, a distance of 164 miles. The project is expected to cost approximately $2,600,000. C. D. Smith, of Fond du Lac, Wis., is president.

The Yakima Southern will construct 90 miles of line from Yakima to Underwood in the state of Washington. Contracts for grading and bridging will be let in May, 1923. The grading on 60 miles of the line through the mountains will be side hill excavation consisting of 30 per cent solid rock, 40 per cent loose rock and 30 per cent earth, and on 30 miles in the valley will consist principally of earth. There will be 12 bridges averaging 100 ft. in length, one tunnel 5,000 ft. long and another tunnel 1,000 ft. long.

Equipment and Supplies

The Boston & Maine is inquiring for some structural steel for use in locomotive shops which it is now building at Concord, N. H.

The Baltimore & Ohio has awarded a contract recently to the American Bridge Company, covering the fabrication and delivery of approximately 750 tons of steelwork for bridge superstructures.

The Chesapeake & Ohio, reported in the December issue as inquiring for 500 tons of steel for bridges, has ordered 400 tons from the Phoenix Bridge Company.

The Chicago, Burlington & Quincy has ordered 106 tons of structural steel from the American Bridge Company for use near Dunlap, Mo.

The Great Northern has ordered 1,210 tons of structural steel from the American Bridge Company.

The Ft. Dodge, Des Moines & Southern has ordered 238 tons of structural steel from the American Bridge Company.

The Louisville & Nashville has ordered 1,599 tons of structural steel for a bridge at Rigolets, La.

The Missouri Pacific has ordered 700 tons of structural steel for two through riveted spans from the Virginia Bridge & Iron Company.

The Pennsylvania Railroad has ordered 500 tons of steel for bridges from the Fort Pitt Bridge Company.

During the last twenty years the Atchison, Topeka & Santa Fe has been appropriating from $10,000 to $20,000 a year for the maintenance of a present total of 30 reading rooms.

Supply Trade News

General

The Pettibone, Mulliken Company, Chicago, will add three one-story buildings to its plant at Chicago, to cost approximately $800,000.

The Ingersoll Rand Company and the A. S. Cameron Steam Pump Works, New York, have opened a branch office at 718 Ellicott Square building, Buffalo, N. Y.

The Lehigh Portland Cement Company has awarded a contract to Dwight P. Robinson & Company, New York, for the design and construction of a Portland cement plant at Birmingham, Ala., having an annual capacity of 1,000,000 barrels.

The Oxweld Acetylene Company, Newark, N. J., has moved the San Francisco office of the western department, of which Leo Romney is manager, from 1077 Mission street, to larger quarters at 1050 Mission street.

Rice & Ilsley, Inc., engineer-appraisers, 18 Tremont street, Boston, Mass., was recently organized by Ernest W. Rice, architect, and Arthur B. Ilsley, engineer of bridges, of the Southern Railway, lines east, with headquarters at Charlotte, N. C. Mr. Ilsley was born at Limerick, Me., on March 29, 1873, and was graduated from Dartmouth College and the Thayer School of Civil Engineering. He entered railway service with the New York, New Haven & Hartford in February, 1896, and subsequently left this road to become assistant bridge engineer on the Boston & Maine, serving in that capacity until March, 1904, when he became assistant engineer in the bridge department of the Southern Railway. In August, 1909, he was promoted to engineer of bridges and served in that capacity until February, 1917, when he was made engineer of bridges, Lines East, following a division of jurisdiction. He held this position at the time of his recent resignation. Mr. Rice was formerly employed by the American Appraisals Company, Milwaukee, Wis., and has had 20 years' experience in this work, during the last two years of which he was district superintendent of the company for New England.

Personal

George H. Humphreys, president of the Steel Rail Supply Company, New York City, died on January 1 at his home, Bronxville, N. Y., at the age of 72.

J. H. Schwacke, manager of **William Sellers & Co., Inc.,** Philadelphia, Pa., and for more than 60 years an employee of the company, has been elected president.

H. A. Hutchins, district manager of the Chicago territory for the Thew Shovel Company, has become associated with the main office of the Northwest Engineering Company, 1220 Steger building, Chicago.

R. M. Chissom, formerly chief clerk to the purchasing agent of the Chicago, Indianapolis & Louisville at Chicago, has been appointed special representative in the railroad department of the Lehon Company, Chicago.

Oliver Crosby, managing partner and head of the manufacturing department of the American Hoist & Derrick Company, with headquarters at St. Paul, Minn., died in that city on December 8 from anæmia.

William R. Walker, assistant to the president of the United States Steel Corporation, died on December 22 in St. Luke's Hospital, New York City. Mr. Walker was born in La Porte, Ind., on November 26, 1857, and had been identified with the United States Steel Corporation since its formation.

William J. Clark, advisory manager of the railway department of the General Electric Company, died at his home in New York City on December 12 at the age of 68. Mr. Clark had been connected with the company for 34 years, his headquarters being at the New York City office of the company.

A. E. Pratt assistant manager, railroad sales division of the National Carbon Company, Inc., with headquarters at

Cleveland, Ohio, has been promoted to manager, railroad sales division, with the same headquarters, to succeed **A. M. Spangler,** appointed asistant district manager, with headquarters at Chicago, Ill.

B. H. Tripp, formerly San Francisco manager of the Chicago Pneumatic Tool Company, has become associated with **F. C. Severin,** formerly of Niles-Bement-Pond Company and Betts Machine Company, in the sale of new and used machinery, with offices at 2220 Chestnut street, Philadelphia, Pa., and 25 Church street, New York City, under the name of Severin-Tripp Machinery Company.

W. D. Hudson, formerly principal assistant engineer with C. E. Smith & Co, consulting engineers, St. Louis, has resigned to become associated in the capacity of transportation engineer with Harland Bartholomew, city plan engineer, St. Louis, Mo. Mr. Hudson will handle railroad and waterway transportation, also grade crossing elimination problems.

Lorenzo C. Dilks, vice-president of the George A. Fuller Company, New York, has resigned to become vice-president of Starrett Brothers, Inc., New York City, with office in Chicago. Starrett Brothers, Inc., is a new corporation, formed to carry on the business of building construction by Paul Starrett, formerly president of the George A. Fuller Company; Colonel W. A. Starrett, formerly vice-president of the George A. Fuller Company, and prior to that chairman of the construction division of the War Industries Board and who was also with Starrett & Van Vleck, architects; Ralph Starrett, formerly of the Thompson-Starrett Company; Andrew J. Eken, formerly vice-president of the George A. Fuller Company, and Lorenzo C. Dilks.

E. J. Akers, general eastern railroad representative of Fairbanks, Morse & Company, with headquarters at New York, died December 25 at Portland, Me., after a service of 51 years with this company. He was born at Sacarappa (Westbrook), Me., on December 1, 1847, and entered the employ of the Fairbanks, Morse & Company as sales representative, with headquarters at Chicago, on March 4, 1869 which position he held until 1888, when he was promoted to general eastern railroad representative. In 1914 this company opened an eastern office at New York, where Mr. Akers was transferred as general eastern railroad representative. He retired from this position in 1920, but remained more or less active until his death.

Warren C. Nixon, vice president of the Western Tie & Timber Company, St. Louis, Mo., and also secretary of the National Association of Railroad Tie Producers and editor of the Cross Tie Bulletin, died at St. Johns hospital, St. Louis, on Monday, January 1, as the result of a nervous breakdown. Mr. Nixon was a widely known and moving spirit among cross tie men and played an important part in welding their interests in the activities of the Tie Producers Association. For the last two years he carried the principal burden incident to the activities of this organization. Warren Nixon was born at Jacksonville, Ill., on February 17, 1886. In July, 1903, he was appointed to the United States Naval Academy at Annapolis, from which he graduated with a small group on September 12, 1906, a full year ahead of his class. Then followed a period of active service in the United States Navy, as ensign on the United States Gunboats Kentucky and Pingey. In 1911 he was commissioned a lieutenant. After several important commands he resigned in the spring of 1912 to become vice president of the Western Tie & Timber Company which position he occupied actively until January 24, 1917, when he reentered the navy and was assigned to active duty as executive officer of the U. S. S. Wainwright which served in Admiral Sims' fleet during the entire period of the war. Recognition of Lieutenant Nixon's service was accorded in his advancement to lieutenant-commander in the fall of 1918 when he was commanding officer of the U. S. S. Patterson. Later he was commissioned commander in Class 1 of the United States Naval Reserve Corps. He then returned to St. Louis and reassumed his duties as vice president of the Western Tie and Timber Company, in which he was actively engaged until about 30 days ago when the breakdown precipitated the illness which caused his death.

Warren C. Nixon

W. E. Caldwell has been appointed sales manager of the Cleveland Twist Drill Company, Cleveland, Ohio, succeeding **E. G. Buckwell,** retired. **Harry Jenson** has been appointed assistant sales manager; **Robert G. Berrington,** sales representative in the Philadelphia district, and **George Kast,** treasurer, has taken on the duties of secretary. Mr. Caldwell, who has been with the Cleveland Twist Drill Company since 1901, was appointed assistant sales manager in 1916. Mr. Jenson was for more than 15 years a representative of the company in the Philadelphia territory, and Mr. Berrington, for 13 years a representative of the sales department in the central states and Canada, has returned to the Cleveland Twist Drill Company after resigning two years ago to act as sales agent for a line of machine tools in the Cleveland territory. Mr. Buckwell, retired secretary and sales manager, previous to 1899 was a traveling salesman for the Sargent Company and later a member of the retail hardware company of McClung, Buffat & Buckwell at Knoxville, Tenn.

W. E. Caldwell

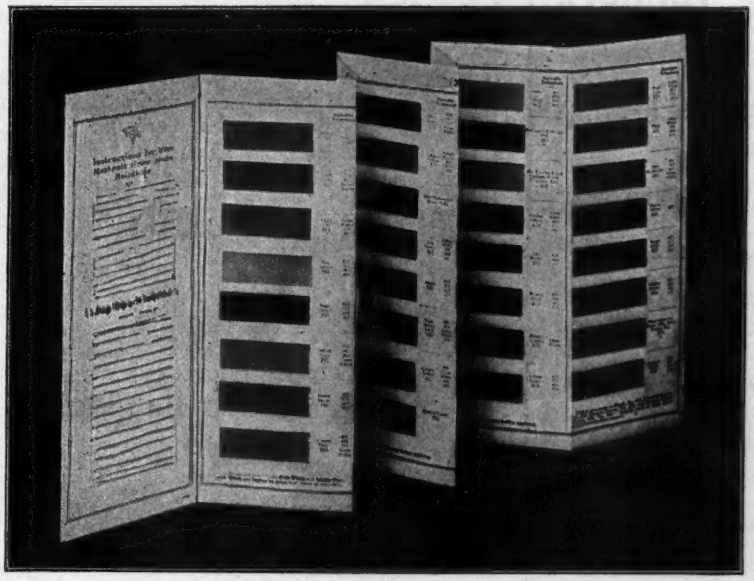
Trade Publications

Permanent Construction for Small Coaling Stations.—In a folder recently issued by Roberts & Schaefer Company, Chicago, the principal features of a new 100-ton fireproof, reinforced concrete coaling station are illustrated and described. This development is the result of studies made over a period of several years to perfect a small coaling station of limited first cost that will incorporate the characteristics of the larger stations with respect to permanent construction and efficient, reliable operation.

Pumps.—A 32-page bulletin, No. 249, has recently been issued by the Dayton-Dowd Company, Quincy, Ill., on its extensive line of centrifugal pumps. This bulletin includes complete descriptions, interspersed with halftone illustrations of details of the pump, together with views showing the various combinations and the pump in typical installations. The descriptions include specifications, speed capacity tables and characteristic curves.

Preliminary returns to the Geological Survey on coal loaded at the mines in the week ended November 11 indicate a total production of 12,600,000 net tons, of which 10,700,000 tons was bituminous and 1,900,000 tons anthracite. The rate of output of soft coal is now higher than in 1918 and 1921, but lower than the same season in 1920.

A Report of the Bureau of Mines on the sale of explosives in the United States shows that of the 2,513,721 kegs of blasting powder, 94,534,927 lb. of high explosives and 16,914,820 lb. of permissible explosives sold in the first seven months of the year, 149,401 kegs of the black powder was used for railway and other construction work and that the high explosives and permissibles used amounted to 10,961,964 lb.



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discharge water horizontally or to an elevation, using the same air which raised it from your wells to the surface.

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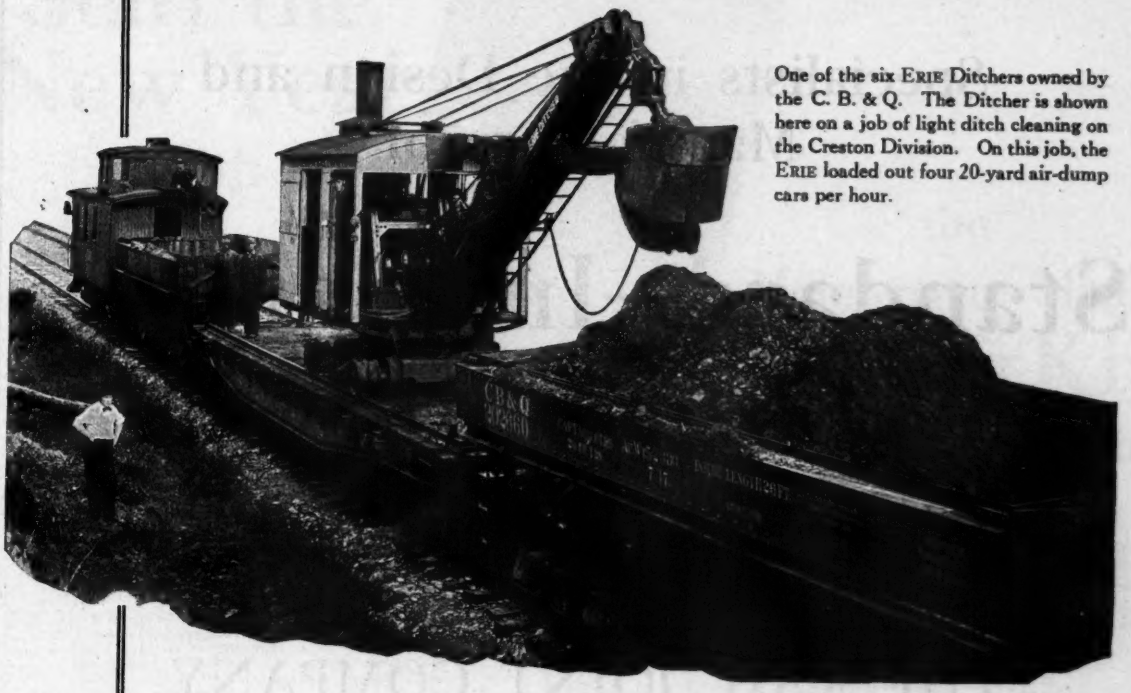

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"The ERIE is far ahead of any other ditcher we've ever had on the Burlington"—

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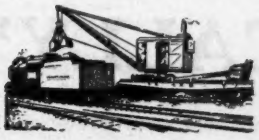

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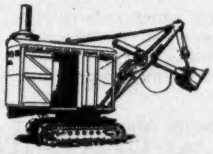

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The ERIE caterpillar type mounting has many features that have set a higher standard for mountings of this kind:

COMPLETE LUBRICATION increases the traveling power and speed, and greatly reduces the wear.

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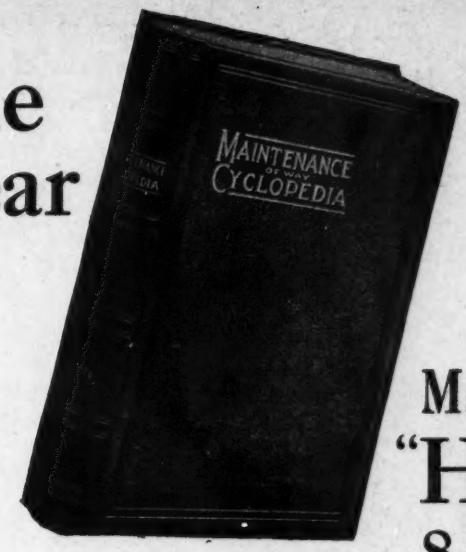

the Maintenance Man's "Handy Kit" 8 Tools in One

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1. **Track Section—210 Pages.**
   Track laying methods and appliances as well as those used in maintenance work are described and defined. Hundreds of drawings, photos and sixteen large folding plates showing switch layouts, etc., are included.
2. **Bridge Section—77 Pages.**
   Types of bridges and methods used in their construction are described and illustrated. A. R. E. A. specifications for bridge design and erection are given.
3. **Building Section—74 Pages.**
   Various types of railway buildings—passenger stations—coaling stations—engine and freight houses, etc., are described and illustrated by photographs of actual buildings and drawings.
4. **Water Service Section—47 Pages.**
   Appliances and tools needed for water service work are described and pictured in a comprehensive manner.
5. **Signal Section—120 Pages.**
   Principles and apparatus used in modern railway signaling are covered. Signal systems are illustrated in detail.
6. **Wood Preservation Section—24 Pages.**
   Treats the subject fully, including a key for the identification of woods as well as specifications for different preservative treatments.
7. **General Section—77 Pages.**
   Information regarding construction and camp equipment as well as a large number of tools and devices which are used in more than one of the foregoing sections is given.
8. **Catalog Section—240 Pages.**
   Describes in a specific manner various machines and appliances used in maintenance work and where they may be obtained.

All the subjects treated in the several sections are listed alphabetically in a **General Index.** The **Catalog Section** contains in addition to the alphabetical **Trade Name** and **Classified Indexes,** detailed descriptions of products you are interested in.

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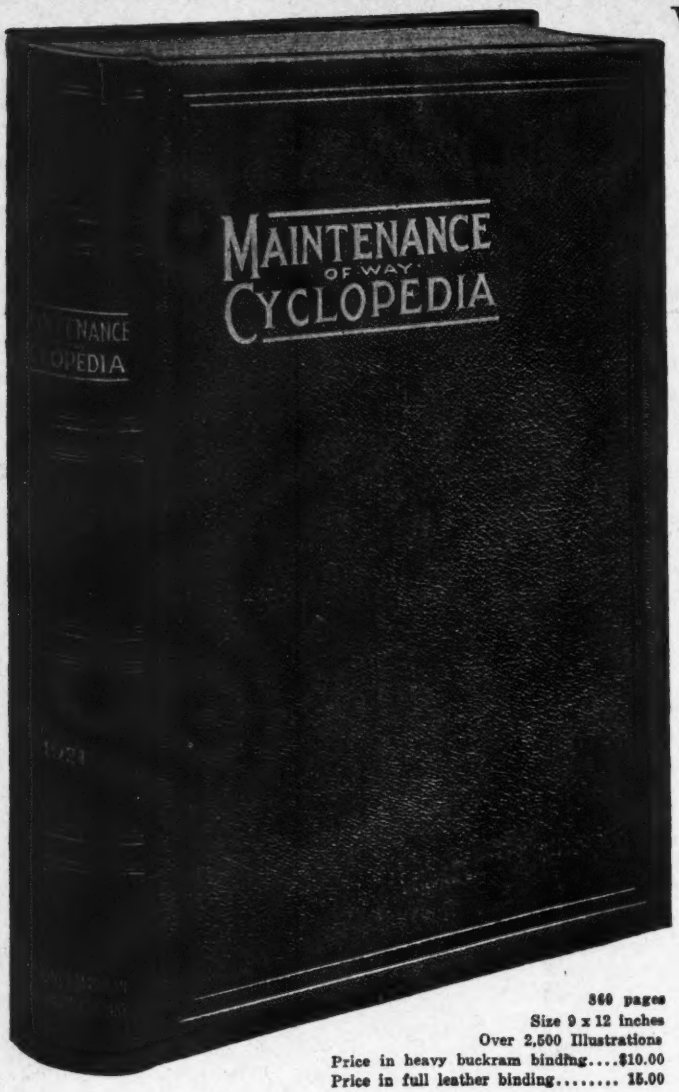

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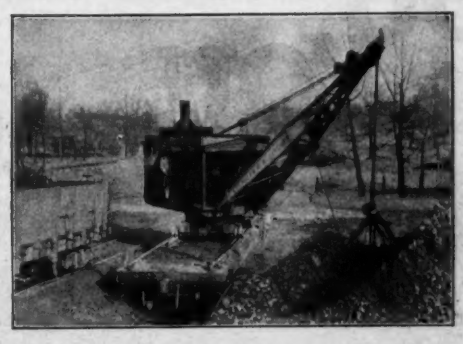

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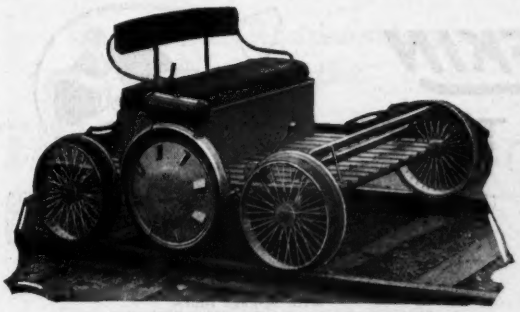

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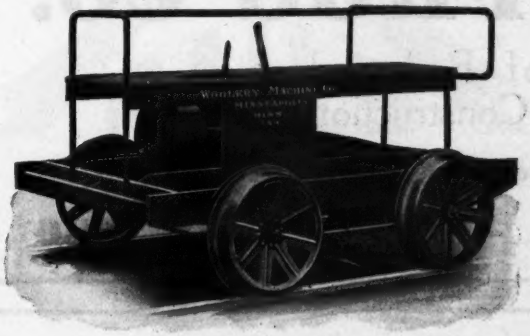

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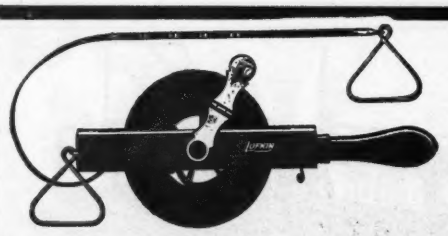

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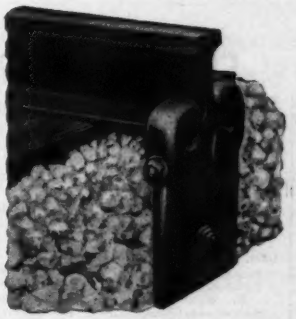

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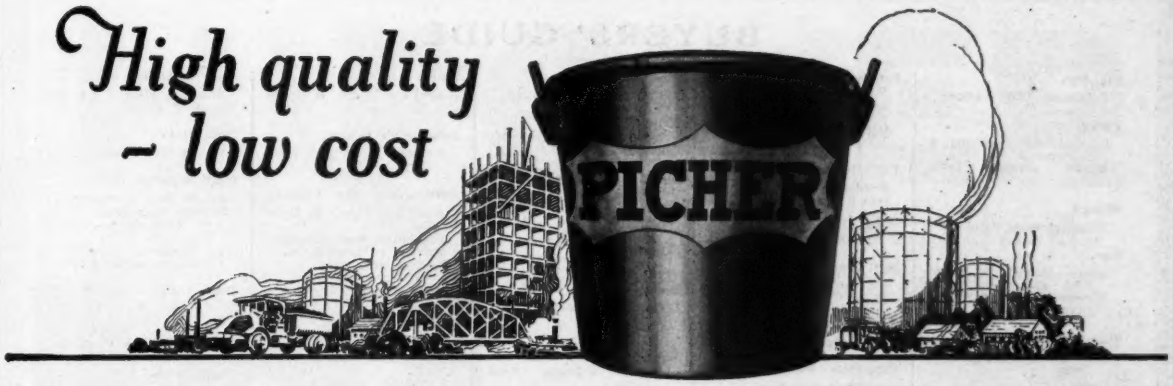

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Ingersoll-Rand Co.

Pneumatic Tools.
Ingersoll-Rand Co.

Poles.
International Creosoting & Construction Co.
Massey Concrete Prod. Corp.

Powders.
E. I. du Pont de Nemours & Co.

Power Houses.
Massey Concrete Prod. Corp.

Preservative, Timber.
International Creosoting & Construction Co.
New Jersey Zinc Co.

Producers, Gas.
Air Reduction Sales Co.

Pumps.
American Well Works.
Fairbanks, Morse & Co.
Goulds Mfg. Co., The.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Push Cars.
Fairbanks, Morse & Co.

Rails.
Bethlehem Steel Co.
Inland Steel Company.

Rail Anchors.
P. & M. Co., The.

Rail Anti-Creepers.
P. & M. Co., The

Rail Braces.
Bethlehem Steel Company.
Louisville Frog & Switch Co.
Q & C Co.
Ramapo Ajax Corp.
Weir Frog Co.

Rail Joints.
Bethlehem Steel Co.
Inland Steel Co.
Q & C Co.
Rail Joint Co.
Wm. Wharton, Jr., & Co.

Rail Saws.
Fairbanks, Morse & Co.
Q & C Co.

Rare Gases.
Air Reduction Sales Co.

Regulators, Oxy-Acetylene.
Air Reduction Sales Co.
Mudge & Co.

Removers, Paint & Varnish.
Mudge & Co.

Replacers, Car.
Q & C Co.

Riveting Hammers.
Ingersoll-Rand Co.
Verona Tool Works.

Rivets.
Bethlehem Steel Company.

Rock Drills.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works.

Rods, Welding.
Air Reduction Sales Co.

Roof Slabs.
Massey Concrete Prod. Corp.

Roofing and Siding.
Fairbanks, Morse & Co.
Lehon Co., The
Ruberoid Co.

Rules.
Lufkin Rule Co., The.

Screw Spike Drivers.
Ingersoll-Rand Co.

Sewer Pipe.
Massey Concrete Prod. Corp.

Sewer Pipe Seal Compound.
Ruberoid Co., The.

Sheets, Fibre.
Diamond State Fibre Co.

Sheet Iron.
Armco Culvert & Flume Mfrs. Assn.

Sheet Steel.
Inland Steel Company.

Shovels.
Wood Shovel & Tool Co., The.

Signal Foundations, Concrete.
Massey Concrete Prod. Corp.

Skid Shoes.
Q & C Co.

Slabs, Concrete.
Massey Concrete Prod. Corp.

Smoke Stacks.
Massey Concrete Prod. Corp.

Snow Melting Devices.
Q & C Co.

Snow Plows.
Q & C Co.

Spikes.
Bethlehem Steel Company.
Inland Steel Co.

Standard Tee Rails.
Bethlehem Steel Company.
Inland Steel Co.

Standpipes.
American Valve & Meter Co.
Fairbanks, Morse & Co.

Station Houses.
Massey Concrete Prod. Corp.

Steam Shovels.
American Hoist & Derrick Co.
Erie Steam Shovel Co.
Osgood Co., The.

Steel Forms.
Blaw-Knox Co.

Steel Plates and Shapes.
Bethlehem Steel Company.

Step Joints.
Q & C Co.
Rail Joint Co.

Street Railway Special Work.
Bethlehem Steel Company.

Structural Steel.
Bethlehem Steel Company.
Inland Steel Company.

Switches.
Bethlehem Steel Company.
Frog, Switch & Mfg. Co.
Ramapo Ajax Corp.
Weir Frog Co.
Wm. Wharton, Jr., & Co.

Switch Locks.
American Valve & Meter Co.

Switchmen's Houses.
Massey Concrete Prod. Corp.

Switchstands and Fixtures.
American Valve & Meter Co.
Bethlehem Steel Company.
Fairbanks, Morse & Co.
Ramapo Ajax Corp.
Weir Frog Co.
Wm. Wharton, Jr., & Co.

Tampers.
Ingersoll-Rand Co.

Tanks.
Fairbanks, Morse & Co.

Tank Valves.
American Valve & Meter Co.

Tapes.
Lufkin Rule Co., The

Telegraph Poles.
International Creosoting & Construction Co.
Massey Concrete Prod. Corp.

Telephone Booths.
Massey Concrete Prod. Corp.

Ties.
International Creosoting & Construction Co.

Tie Plates.
Bethlehem Steel Company.
Inland Steel Company.
Lundie Engineering Corp.

Tie Rods.
Bethlehem Steel Company.

Tin Plate.
Bethlehem Steel Company.

Tongue Switches.
Bethlehem Steel Company.

Tool Steel.
Bethlehem Steel Company.

Tools, Oxy-Acetylene Welding and Cutting.
Air Reduction Sales Co.

Torches, Oxy-Acetylene Welding and Cutting.
Air Reduction Sales Co.

Track Drills.
Ingersoll-Rand Co.

Track Insulation.
Diamond State Fibre Co.
Q & C Co.

Track Jacks.
Verona Tool Works.

Track Material.
Inland Steel Company.
Ramapo Ajax Corp.
Weir Frog Co.

Track Scales.
Fairbanks, Morse & Co.

Track Tools.
Fairbanks, Morse & Co.
Q & C Co.
Verona Tool Works.
Warren Tool & Forge Co.

Trestle Slabs.
Massey Concrete Prod. Corp.

Vacuum Pumps.
Ingersoll-Rand Co.

Varnish, Electrical Insulating.
Ruberoid Co., The.

Washers.
Diamond State Fibre Co.

Water Column.
American Valve & Meter Co.

Waterproofing.
Ruberoid Co., The.

Welding, Oxy-Acetylene.
Air Reduction Sales Co.

Weed Killer.
Chipman Chemical Engineering Co., Inc.
Reade Mfg. Co.

Wheels (Hand and Motor Car).
Fairmont Gas Engine & Ry. Motor Car Co
Maintenance Equipment Co.
Mudge & Co.
Woolery Machine Co.

Wire.
Armco Culvert & Flume Mfrs. Assn.

Wire Rope.
Fairbanks, Morse & Co.

Wood Preservative.
Chipman Chemical Engineering Co., Inc.
International Creosoting & Construction Co.
Reade Mfg. Co.

Zinc Chloride.
New Jersey Zinc Co.

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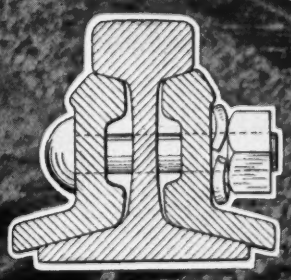
HIPOWER

Raise Your Standards of Track Maintenance



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Established 1886

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NASHVILLE
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Sentry Duty at the Track Watering Tanks

ON one of the big Eastern railroads, maintenance of joints at the track watering tanks was particularly difficult.

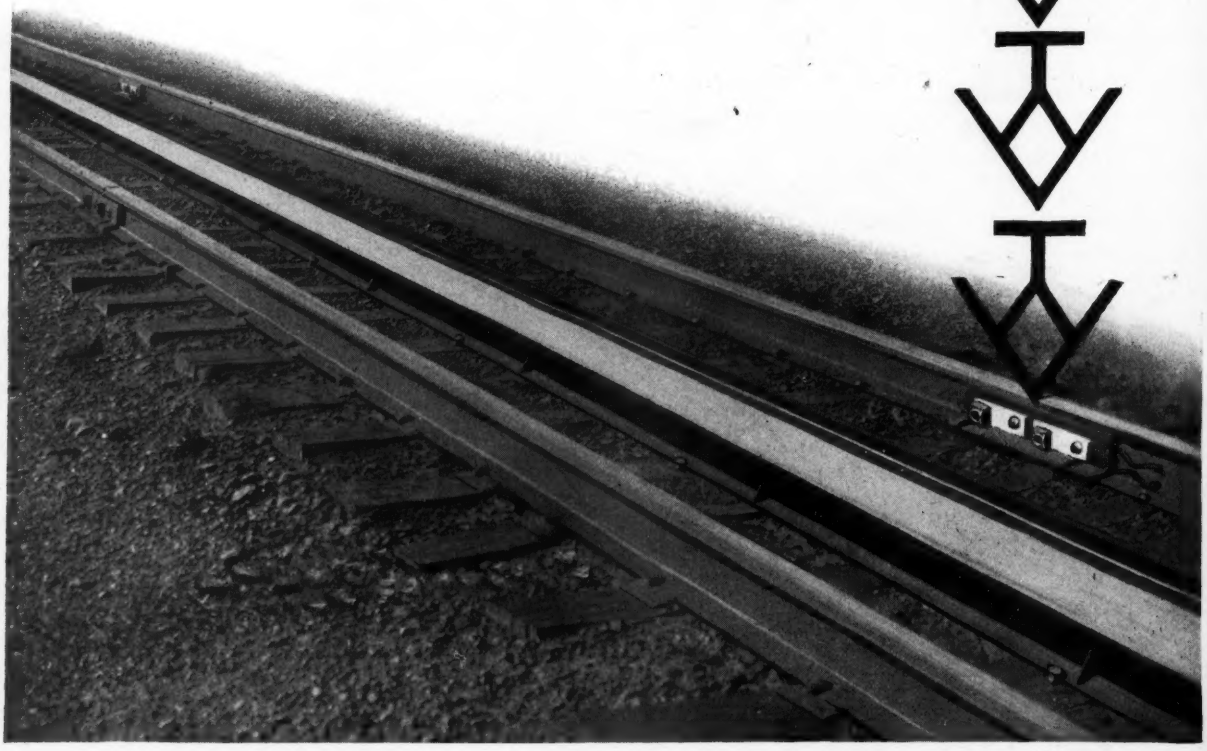
The increased vibration, due to the impossibility of proper drainage, the constant rusting from the splashing water, and the need for perfect track for the proper operation of the scoops made necessary the employment of an extra man to do nothing but tighten bolts all day and every day.

Sentry duty at the track watering tanks was regarded as an inevitable necessity.

THEN they tried Verona Rail Joint Springs.

The extra man has been let go. The springs now do the sentry duty. There is no longer any need of tightening bolts. The springs keep them tight.

If they will serve so effectively at such difficult points, is it not evidence that they are vastly superior to ordinary nutlocks at any and every point in a track?

We repeat our injunction of several months ago, "Try them in the worst places first."

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Pittsburgh, New York, Chicago